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THE NEW CONCEPTS IN THE ARRANGEMENT OF RIVER BEGA

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Abstract: Throughout the twentieth century, the principle of nature domination led to a productivist approach to water management. Floods are natural phenomena and are a component of the Earth's natural hydrological cycle. These are some of the natural phenomena that have marked and profoundly mark the development of human society, and they are geographically the most widespread disasters in the world and also the largest producers of human damage and casualties. Over time, mankind has tried to combat these relentless natural phenomena by various means. The negative consequences that they induced on the watercourses as well as the change of the way of producing the floods led to the elaboration of new concepts of river arrangement, concepts that will be analyzed in this paper.

Keywords: watercourse, structural measures, hydrological regime, ecosystem

1. INTRODUCTION

In Romania, watercourses have undergone profound transformations to use their functions for the development of economic and social activities. There are sufficient cases in which the hydro morphological transformations of rivers for the use of economic functions have affected their ecological functions by reducing aquatic biodiversity.

The new concept of river management is based on the principles of sustainable development that start from the idea that "water is a heritage that must be protected, preserved and treated as such." The Water Framework Directive and the Directive for Assessment and Management of Flood Risk promote a new concept of river management with the main objectives of reducing the risk of floods and conserving the biodiversity of the aquatic environment.

These ecosystems depend on the regime of watercourses in which flows, sediment transport, water temperature and other variables have a well-defined role. In case of changes in these variables compared to the naturally occurring values, the balance is disturbed. It is the reason why the arrangement of rivers through engineering works must have as objective the maintenance in time and space of the global dynamic balance of the watercourses.

The dams of watercourses on long river sectors have led not only to the reduction of the biodiversity of the aquatic environment but also to the attenuation of the maximum flows. In recent years, climate change has led to rising water levels.

2. STRUCTURAL MEASURES

Dams are structural measures implemented in order to protect against floods, with the change of the natural drainage regime. In addition to the positive effects of flood protection and damage reduction, dams also cause negative effects such as a turbulence in the upstream region that creates increases in levels and flows, a speed of translation of increased flood waves, a modified regime of solid flow of the river, but also changes in the structure and texture of the lithology of the major riverbed, soil and characteristic fauna and flora.

In the case of river sectors bounded by dams, it is considered necessary to restore the old characteristics of the plan route of a body of water, especially in situations of high water.

Figure 1. Breach in Dam , Timis River

Rectification of a watercourse by cutting meanders are the most used riverbed control works performed in order to increase the transport capacity of a riverbed to small and medium waters.

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Although effective in ensuring certain uses, meandering cuts have many effects such as increasing the risk of flooding by increasing water velocity and erosion, the disappearance of wetlands and characteristic species (figure 2). [după Şerban, P., Gălie, A., 2006]

Figure 2. Meander reopening

The advantages of this structural measure are:

• creating an additional living space for the watercourse.

• the appearance of wetlands between the arms of the river, implicitly of new habitats;

• increasing the transport capacity of the riverbed during periods of high water;

• acceptable investment costs.

The recalibration of a watercourse (figure 3) aims at increasing the discharge capacity of the flows in the minor riverbed, modifying the bed of the riverbed both in transversal and in the longitudinal profile. Acting on the longitudinal profile and on the transverse profile for the upper use of the riverbed for navigation, shore protection or water catchment influences the regime of liquid and solid flows.

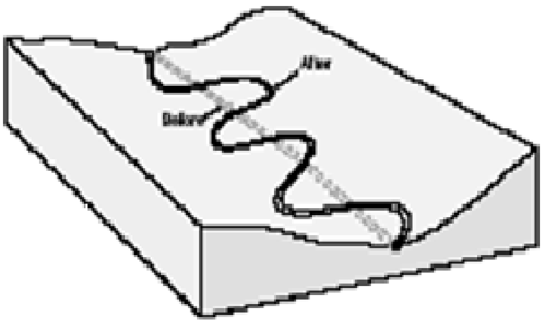

Figure 3. Schematic presentation of the restoration of a recalibrated watercourse

By shortening the riverbed, there is an increase in the slope and therefore a deepening of the riverbed and a decrease in water level.

The change in the plan of the river route is accompanied by a change in the cross section of the riverbed, from a natural profile to a strongly modified one (figure 4).

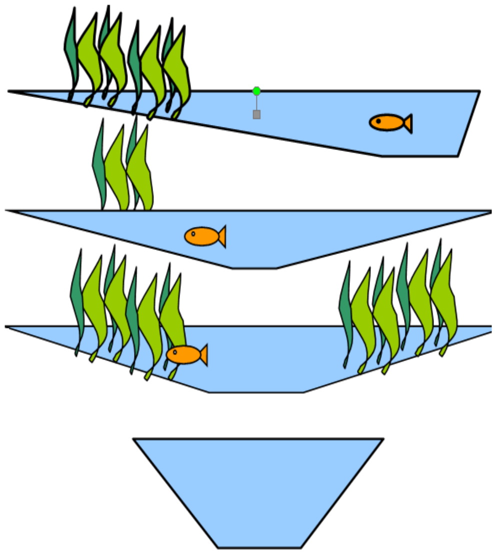

Figure 4. Changes in the transverse profile from the natural to the trapezoidal profile

A buffer zone is an area with vegetation, usually trees and shrubs, but also other plant species, along a watercourse that is created to maintain the integrity of river functions, reduce pollution, provide food and habitat, and provide thermal protection to fish and other species. Buffer zones filter sediments and nutrients and also play a role in stabilizing slopes. In general, the buffer zone comprises 2-3 sub-zones: the internal zone (minimum 6 m), where the vegetation is mainly represented by trees, the middle zone, with trees and shrubs where clearing areas are also accepted, and if possible a outdoor area (6 m) where the development of the forest is encouraged, but other plantations are allowed.

Uses within the buffer zone are restricted so that the role of protecting the physical integrity of aquatic ecosystems has an effect (eg only flood defense activities). In the case of urban areas, the uses can be wider, including recreational ones.

The creation of buffer zones (figure 5) is used especially in the case of watercourses that cross areas with intensive agriculture.

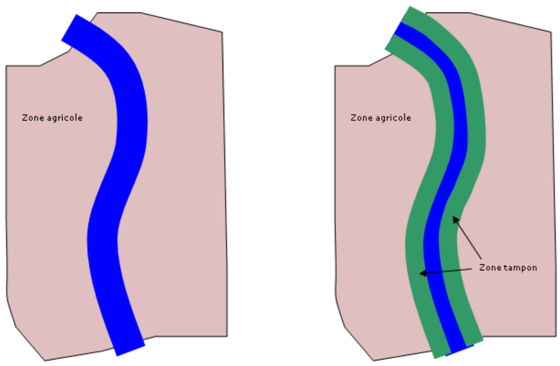

Figure 5. Buffer zones

Redevelopment of riverbanks and lakes with vegetation is one of the most used remediation measures, due to low costs and high ecological efficiency.

This measure is used in the case of watercourse sectors which are characterized by an excessive increase in water temperature due to high air temperatures and especially increased insolation.

Excessive increase in water temperature is a factor favoring the occurrence of eutrophication processes, and the planting of trees on the banks of these courses prevents exposure to prolonged insolation by canopy.

Also, the redevelopment of the banks with vegetation has a beneficial effect on the dynamics of erosion and sedimentation in the watercourse, stabilizes the banks, protects and provides specific habitats for other aquatic organisms, etc.

Pasture management is a very effective non-structural measure, especially when it is combined with other non-structural or structural measures. For example, in the case of biological slope consolidation or the creation of wetlands or buffer zones, grazing management is required, especially in the initial periods when the renaturated vegetation is in the growing period. Once the vegetation has settled and the slopes have stabilized, a rational grazing can be included in the management plans of the rehabilitated water bodies.

Wetlands (figure 6) represent stretches of ponds, swamps, peat bogs, having as sources natural or artificial waters with permanent or temporary character. Wetlands are natural reservoirs for water accumulation during floods, are a specific habitat for wildlife and can help maintain water quality.

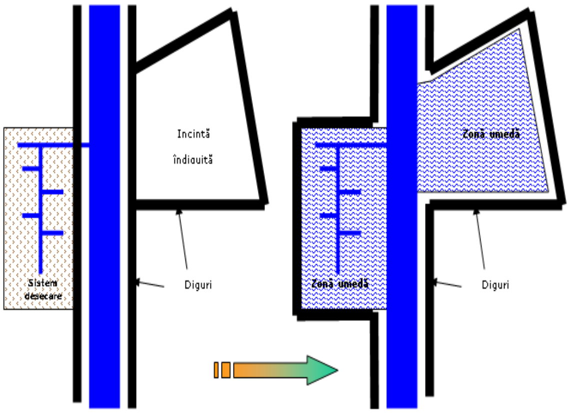

Figure 6. Wetlands

These works aim to increase the depth and volumes of lakes to increase fish production, remove nutrient-rich sediments, toxic materials and combat the excessive abundance of aquatic plants.

3. BEGA RIVER ARRANGING

The Bega River springs from the Poiana Ruscă Mountains, below the Padeş peak, at an altitude of 1,150 m. The Bega River crosses the heavily forested mountain area from south to north, and then heads west, the meadow area surrounded by Piedmont hills widening more and more until the transition to the plain area. The hydrographic network is very rich, with the left and right tributaries generally rising downstream.

The upper course of the river Bega is considered to be located upstream of the Timiş-Bega supply canal, with a total reception basin of 1,342 square km.

The location of the proposed regularization works is in the middle sector.

The general slope of the bed of the lateral tributaries of the river Bega varies between 1% and 10%, and the cross section of the riverbed, in most cases, is very small.

The Bega River is regularized on a natural course length of 31.26 km. The regularization works of the Bega River consist of:

- Regularization of the minor riverbed by calibration and recalibration works at a trapezoidal section with a unique profile, increasing from upstream to downstream depending on the calculation flow and depth.
- The slopes were provided with a 1: 3 inclination on the sectors consolidated with a rough stone wall.
- The re-profiling of the existing riverbed is done by widening and deepening. The cutting of the loops occurred only where the meanders were very pronounced and the regularization of the riverbed on their route was totally inadequate from a hydraulic, functional and economic point of view.
- The consolidation of the bank of the minor riverbed of the river Bega (figure 7) was generally provided in the areas with active erosion, at the cutting of meanders and at the confluence with its tributaries for a stable route of the minor riverbed.
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Figure 7. Consolidation of the right bank downstream of Curtea locality

- Bottom sills. For the stabilization of the riverbed in cross section and in length, it was foreseen the realization of some thresholds made of raw stone on the whole section.
- Embankment of the minor riverbed with homogeneous earth dams, systematized deposits at mandatory elevations and parapet walls with the role of dam in areas with existing constructions near the shore;
- The parapet walls (figure 8) were proposed on some sections, on a total length is 1,937 m;

Figure 8. Concrete parapet

4. CONCLUSIONS

The magnitude and frequency of floods are likely to increase in the future as a result of climate change, wrong management of rivers and construction in areas at risk of flooding.

Floods are a natural phenomenon that cannot be prevented. However, human activities contribute to increasing the likelihood and magnitude of the negative impact of floods.

The combination of technical measures with non-structural measures and the elaboration of a detailed economic analysis requires the involvement of a multidisciplinary staff in the water management process. Bioengineering techniques and technologies result precisely from the overlapping of structural and non-structural renaturation measures, overlapping carried out taking into account in addition to the conditions of technical and ecological efficiency and economic, all designed locally, but in a broader framework of basin planning.

The negative consequences of the inadequate management of watercourses as well as the change in the way floods are produced led to the elaboration of a concept for their arrangement, generically called "more space for rivers". This new concept involves the harmonization of social and economic requirements such as water supply, flood protection and others with ecological requirements.

Such measures ensure the continuity of the river and its connection with the floodplain for the creation of habitats (wetlands) for the conservation of aquatic flora and fauna, flood mitigation and nutrient retention.

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