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Advance hydraulic modeling of Dognecea river, Romania, Caras Severin county

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Abstract: Study case is situated in Caras Severin county. To solve theoretical problems of movement of water in the river Dognecea, it requires modeling of water flow in this case. Numerical modeling was performed using the program MIKE11. Advanced computational modules are included for description of flow over hydraulic structures, including possibilities to describe structure operation. The input data are: area plan with location of cross sections; cross sections topographical data and roughness of river bed; flood discharge hydrograph. After simulation with MIKE 11 result the water level in each cross sections.
Keywords: Hydraulic modeling, roughness of river bed

1. INTRODUCTION

Dognecea town, located at the foothills Dognecea Dognecea crossed the brook, ancient settlement is mentioned in documents in 1722, which retains architectural monuments (churches) in the eighteenth and nineteenth centuries.

Caras left tributary of the river, brook flows from Dognecea Dognecea Mountains and runs through broad valleys and hilly areas with terraces and alluvial deposits consist of lossoidale.

Currently, the built-up area is manifested in the upstream end of the work the phenomenon of erosion of banks with endangering the stability of houses, the county road and in the downstream area of the village occurred clogging full bed, which led the overflow stream and river beds through the formation of new households in the area.

On the upstream area downstream of the dam village in the valley is deep to bedrock, banks are eroded, subspălate existing works, and the area is currently unconsolidated erosion phenomenon. Following floods recorded, existing works on the section downstream dam and town hall are damaged, stone masonry walls were subspălate were destroyed bridges.

On the downstream sector, due to low slopes and transport of loose material in the upstream area is deposited in the downstream area of the village, where the lack of excessive clogging banks and lead to flooding of roads and common households Figure 1.

Preparation of the brook Dognecea are taken to avoid damage due to floods in the territory localities bordering on the said sector.

Dognecea river basin upstream of the confluence Calina has the following characteristics:

- Course length: L = 18km
- S = basin area 61km2
- Altitude: - Upstream: 420mdM
- Downstream 151mdM
- Average elevation 388mdM
- Average slope of 15 ‰
- 1.27 coefficient of convolution
- 4741ha forest area

To ensure the transition flow calculation probability of exceedance Q5% were performed calculations for sizing section, verifying the ability of natural riverbed.

In conclusion, Section reshaping creek Dognecea was set at a trapezoidal section with slopes to the shore of 1: 1.5 and 8.00m width at the base and apply a length of 2000m in the downstream area of the village Dognecea.

Embankment resulting from excavation will be used for fillings in the back or sides work through compensation between profiles.

Weight retaining wall of stone, L = 1000 m applies Dognecea creek in the road and the houses on the sides (erosions and overload applied field).

Consolidation bank with gabion boxes L = 1165m- having 1.00x1.00x section 3.00m, 1.00x1.50x3.0m of concrete steel frames OB37 Ø16mm placed at 1,00m distance and OB37 Ø10mm internally welded to 0.50 m distance, whereon Ø3,8mm mesh galvanized mesh 40x40mm. The boxes are filled with stone, the foundation will be done on a mat 0.30m and 3.00m fascinated by length. Stone will sit as dry walling manual. The boxes will bind all directions with OBØ6 at 0.20cm away. Will apply on both sides of the brook to protect road construction riparian complement existing work and stop the phenomenon of entrainment of material.

Gabion boxes on Fascia and revetment mat slope embroidered on to the calculation h = 2.00m - L = 2130ml, will apply to protect the eroded banks. The section consists of a box gabion having dimensions 1,00x1,00x3,00m section on elastic mattress foundation of 0.30M Fascia thick with 1,00m length free. To ensure the required height embankment transit flow

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calculation were provided by pitching embroidered 1.00m from 0.30m the crushed stone for drainage layer of ballast 0.15m.

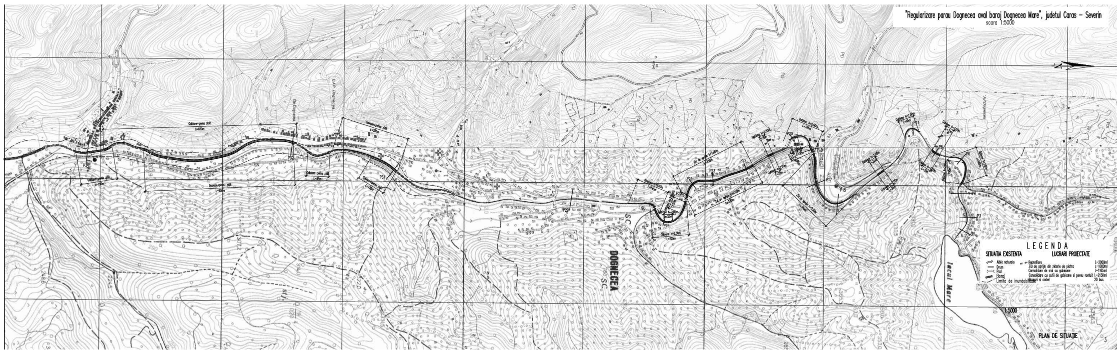

Figure 1. Plan view

Fall of gabion boxes h = 0,50m 5 piece (L = 35m). To stabilize the riverbed, reducing the longitudinal slope of the course, reducing leakage rates and maintaining quotas for foundations work proposed thresholds will be achieved with the fall of gabion boxes. Section consists of gabion box 0.50x2.00x3.00m threshold spillway with concrete block beam (0.50x1.00m), sink energy 7.00m in length made of two 0.50x3.00x3.00 gabion boxes.

Fall of gabion boxes of 10 pieces h = 0.30M (L = 80m). Section consists of gabion box 0.30x3.00x3.00m threshold spillway with concrete block beam (0.50x1.00m), sink energy 7.00m in length made of two 0.30x3.00x3.00 gabion boxes, 1.00x3.00x3.00m respectively. The boxes are trapped in the concrete beam downstream of 0.50x1.00m. Risberma length of 4.00m is made up of rockfill g> 440kg / piece.

The bottom sill 5 pcs. (L = 50m) has a length of 5.00m and 1.30m deep riverbed designed to share, embankments 1: 1. It is made of stone riprap g> 440kg / pc, being covered with a layer of concrete 0.10m ciclopian C8 / 10.

2. MATERIAL AND METHODS

Numerical modelling was performed using the program MIKE11. MIKE 11 is a professional engineering software package for the simulation of flows, water quality and sediment transport in estuaries, rivers, irrigation systems, channels and other water bodies.

MIKE 11 is a user-friendly, fully dynamic, one-dimensional modelling tool for the detailed analysis, design, management and operation of both simple and complex river and channel systems.

With its exceptional flexibility, speed and user friendly environment, MIKE 11 provides a complete and effective design environment for engineering, water resources, water quality management and planning applications.

The Hydrodynamic (HD) module is the nucleus of the MIKE 11 modelling system and forms the basis for most modules including Flood Forecasting, Advection-Dispersion, Water Quality and Non-cohesive sediment transport modules.

The MIKE 11 HD module solves the vertically integrated equations for the conservation of continuity and momentum, i.e. the Saint Venant equations.

Applications related to the MIKE 11 HD module include:

- Flood forecasting and reservoir operation
- Simulation of flood control measures
- Operation of irrigation and surface drainage systems
- Design of channel systems
- Tidal and storm surge studies in rivers and estuaries.

The MIKE 11 is an implicit finite difference model for one dimensional unsteady flow computation and can be applied to looped networks and quasi-two dimensional flow simulation on floodplains.

The model has been designed to perform detailed modelling of rivers, including special treatment of floodplains, road overtopping, culverts, gate openings and weirs.

MIKE 11 is capable of using kinematic, diffusive or fully dynamic, vertically integrated mass and momentum equations.

Boundary types include Q-h relation, water level, discharge, wind field, dam break, and resistance factor.

The water level boundary must be applied to either the upstream or downstream boundary condition in the model.

The discharge boundary can be applied to either the upstream or downstream boundary condition, and can also be applied to the side tributary flow (lateral inflow).

The lateral inflow is used to depict runoff. The Q-h relation boundary can only be applied to the downstream boundary.

MIKE 11 is a modelling package for the simulation of surface runoff, flow, sediment transport, and water quality in rivers, channels, estuaries, and floodplains.

3. RESULTS AND DISCUSSIONS

Numerical modelling was performed with the program MIKE11. Site plan in this situation is shown in Figure 2.

Cross sections through the channel as topographical surveys are shown in Figure 3.

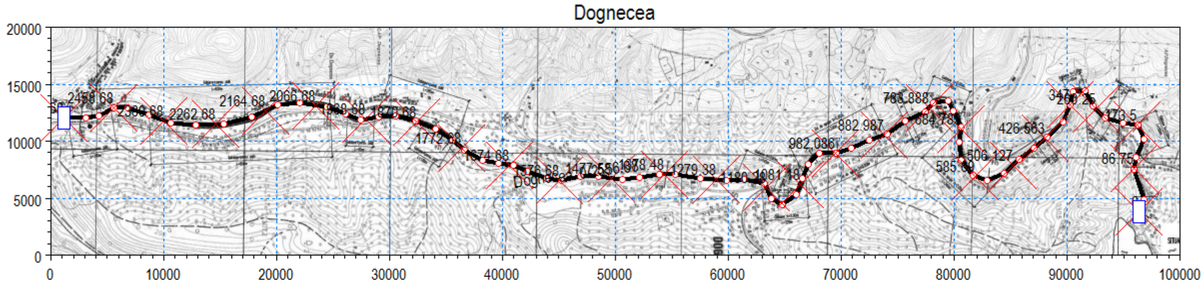

Figure 2. Plan view with the network model

According to data entry or formulated boundary conditions, namely the upstream inflow at chainage 0 are constant Q 19,9 mc/s and in the downstream at chainage 0 curve key for downstream section of the river. After running the program MIKE11 was obtained through existing channel longitudinal profile, presenting water levels along the channel (Figure 4).

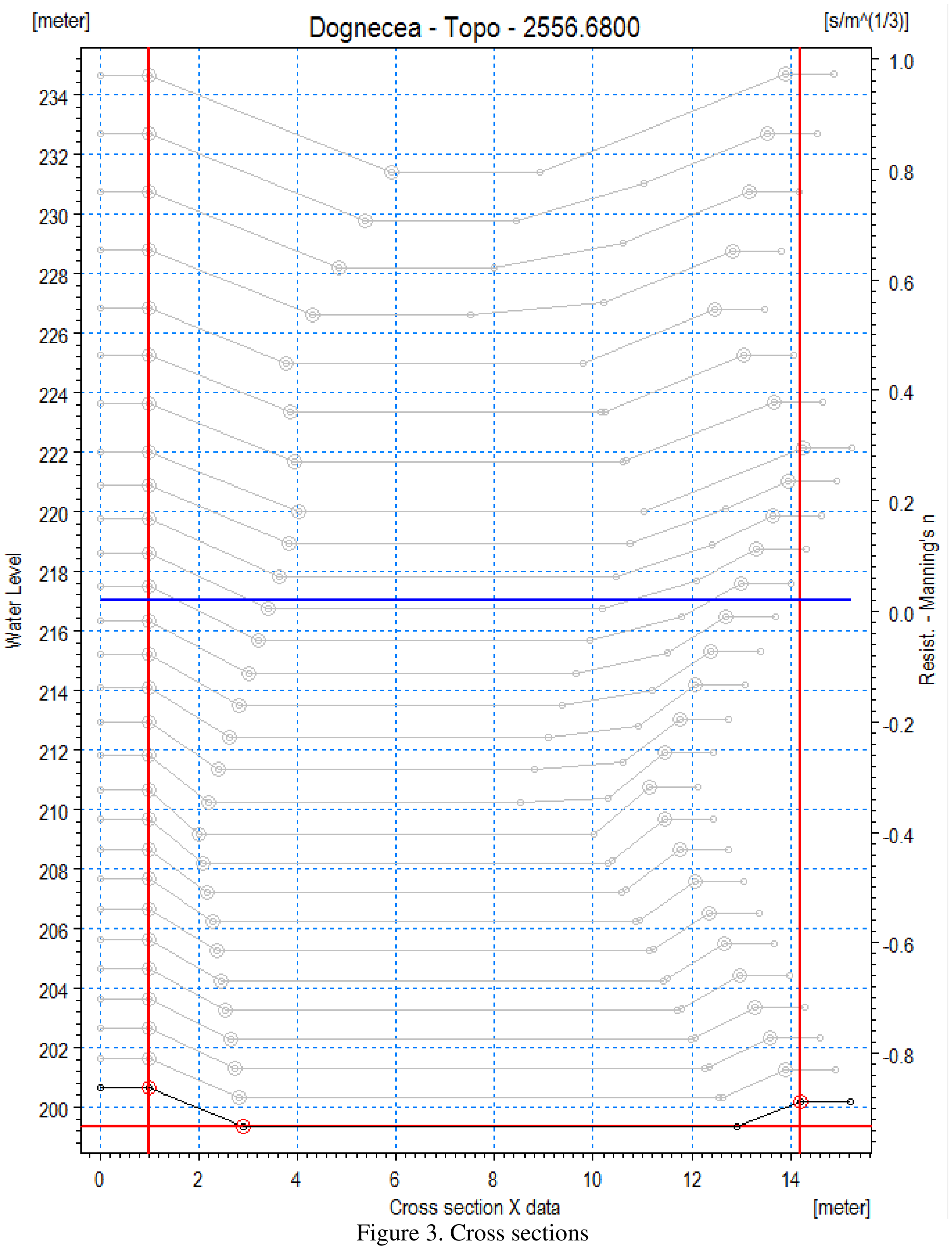

Figure 3. Cross sections

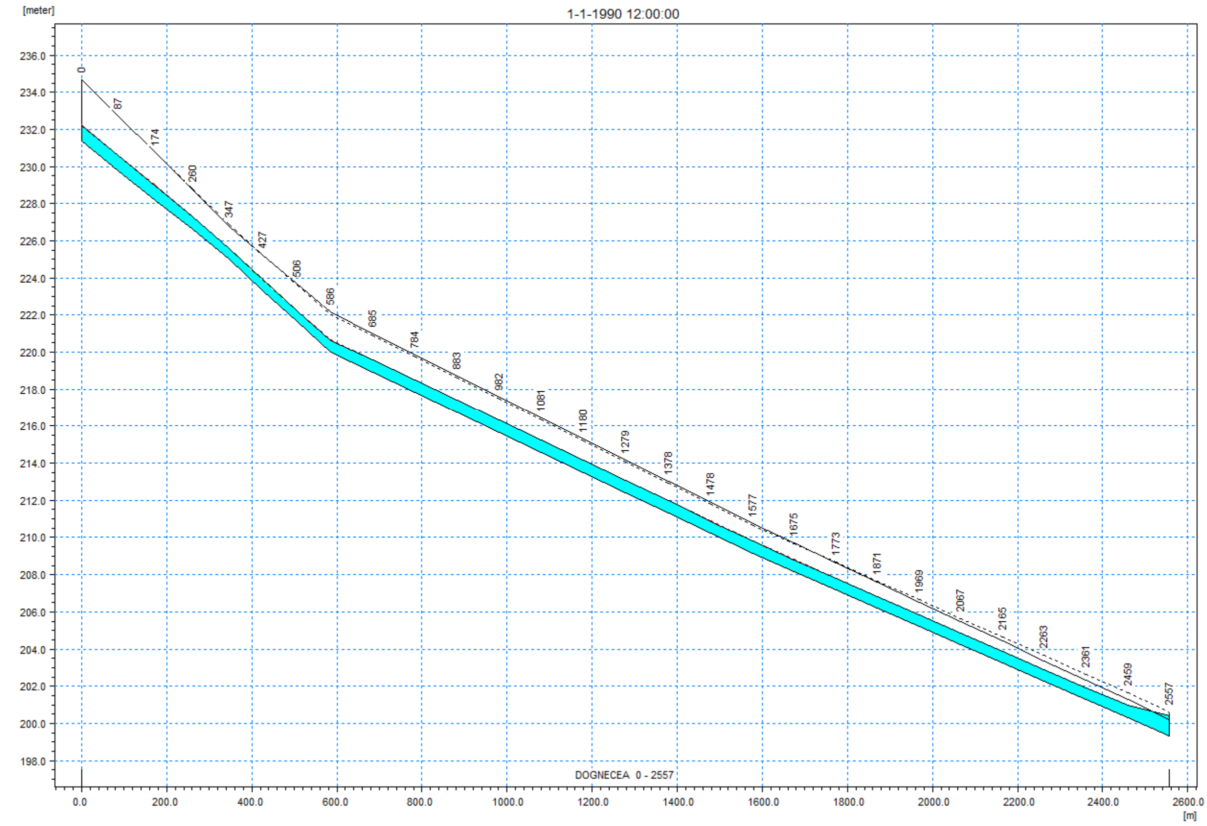

Figure 4. Longitudinal profile

This study presents the application of a 1-dimensional unsteady flow hydraulic model used for the simulation of flow in rivers: the MIKE 11 model from the Danish Hydraulic Institute (DHI).

MIKE 11 is the preferred choice of professional river engineers when reliability, versatility, productivity and quality are the keywords.

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