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WATERCOURSE HARNESSING BANK EROSION AND CONSOLIDATION

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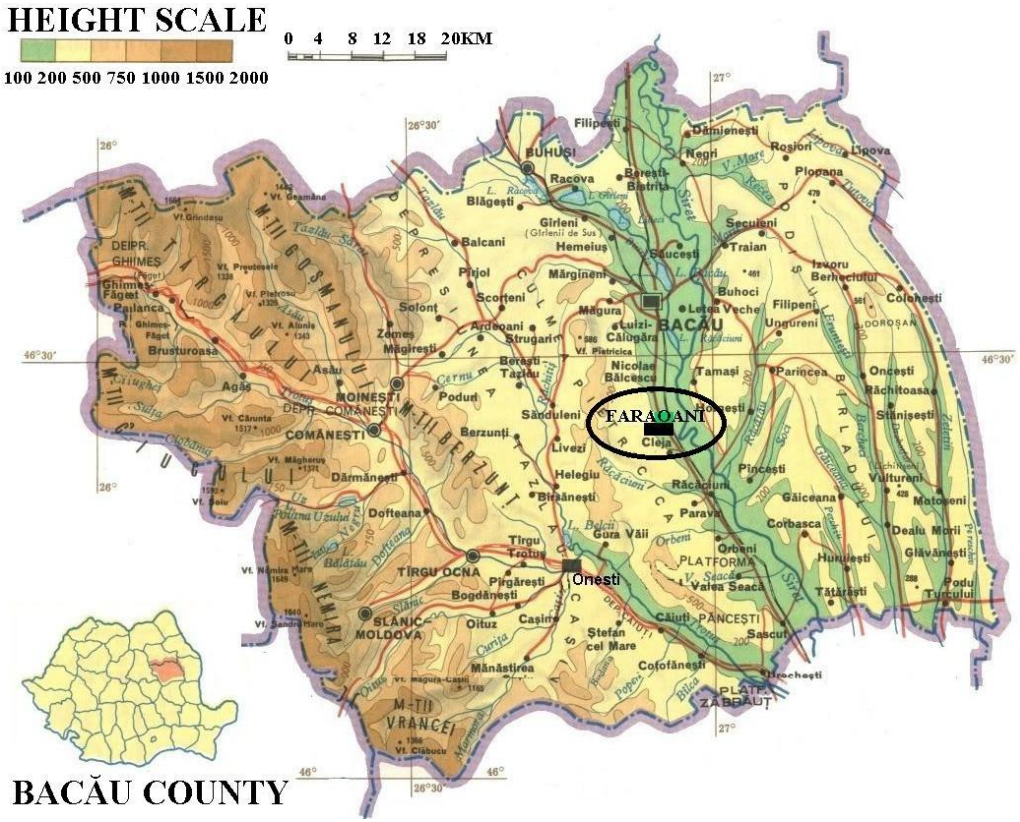
OUTLINE

- **Introduction**
- **Climatic, hydrological, geotechnical and seismic data**
- **Degradations occurred in the studied area due to a rapidly increasing water flow**
- **Solutions for harnessing small watercourses**
- **Conclusions**

INTRODUCTION

- water sources are the key element that determines the placing of human settlements in a region;
- watercourses can become with a high flow due to climatic factors and the relief present in the area;
- this situation occurred in Faraoani which lies on a part of the eastern slopes Moldavian Subcarpathians;
- altitudes 140-600 m;
- relief: deep valleys, hills.



CLIMATIC, HYDROLOGICAL, GEOTECHNICAL AND SEISMIC DATA

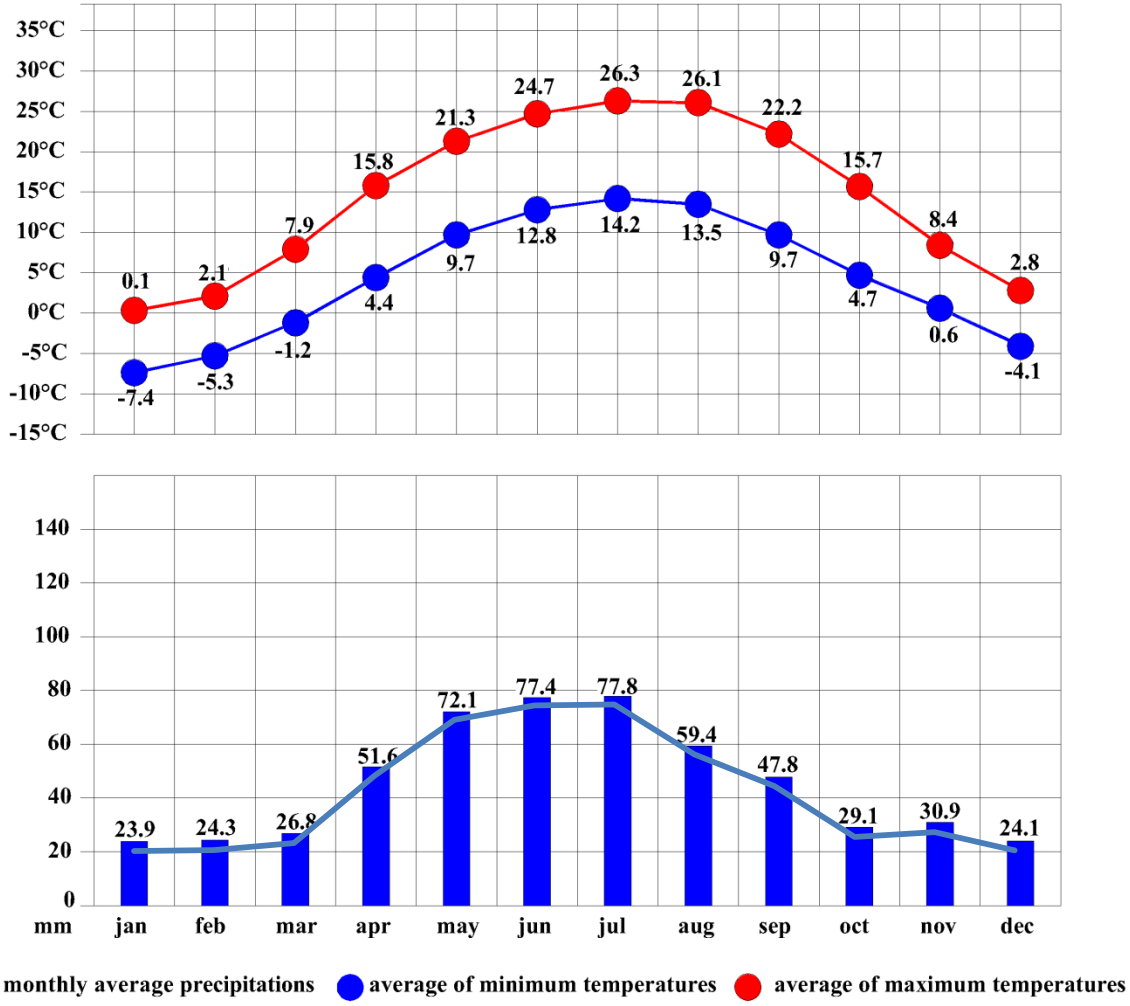
Climatic data

- excessive temperate-continental climate;
- the average annual air temperature has a value of *9.2°C*;
- standard depth of freezing of soil is *0.90 m*;
- the estimated wind speed for a 50-year average recurrence interval is *35 m/s*;
- the reference wind pressure *0.50 kPa*;
- characteristic ground snow load $s_{0,k}$ = *2.50 kN/m²*.

Hydrological data

- average annual precipitation quantity *550 mm*;
- relative air humidity is *70÷75%*;
- irregular rainfall, with frequent heavy rains in June and July, thus producing erosion on deforested land surfaces.

CLIMATIC, HYDROLOGICAL, GEOTECHNICAL AND SEISMIC DATA



CLIMATIC, HYDROLOGICAL, GEOTECHNICAL AND SEISMIC DATA

Geotechnical data

- geological drillings were performed up to -3.0 meters from the natural ground level;
- the lithology of the area consists of a coarse sedimentary horizon composed of gravel, boulder and sand.

Seismic data

- horizontal design ground acceleration $a_g = 0.28 \cdot g$;
- corner period $T_C = 0.70$ *seconds*.

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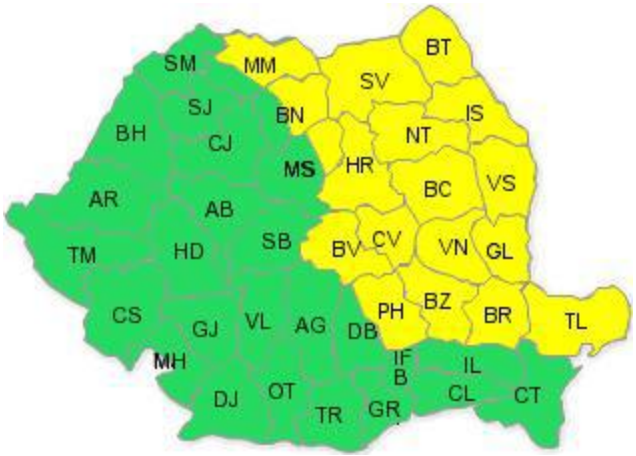
DEGRADATIONS OCCURRED IN THE STUDIED AREA DUE TO A RAPIDLY INCREASING WATER FLOW

- result of the interactions between supplying and flowing conditions of the watercourse in the area;
- sudden and brief increases in water level as a result of torrential rains led to floods;
- floods are seasonal with an outlined period of increase and decrease of water flow.

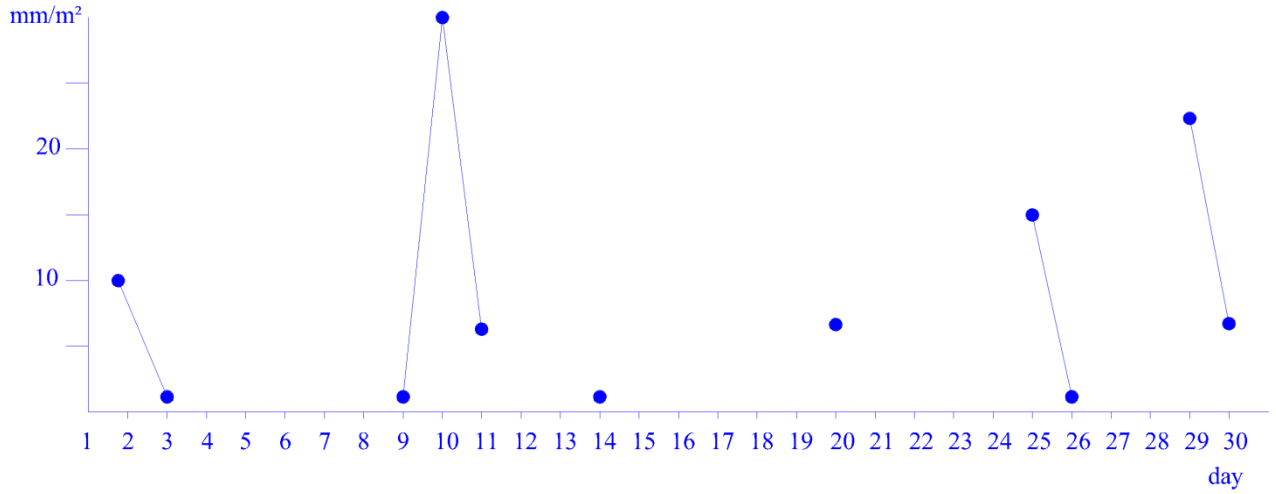


June 2010

June 2011

DEGRADATIONS OCCURRED IN THE STUDIED AREA DUE TO A RAPIDLY INCREASING WATER FLOW

DATE	QUANTITY OF PRECIPITATION	
	local [l/m^2]	isolate [l/m^2]
25 June 2010	60-70	100
28 – 29 June 2010	20	40
30 June – 1 July 2010	25	40
7 July 2010	30	60
10 – 11 July 2010	25	50
8 – 9 August 2010	20	35
31 August 2010	25	50
9 – 11 June 2011	30	70
28 – 29 June 2011	25	50



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DEGRADATIONS OCCURRED IN THE STUDIED AREA DUE TO A RAPIDLY INCREASING WATER FLOW

- **forces reached their maximum intensity during floods, due to rising water level and caused sediment displacement;**
- **degradations to a retaining wall made in 1975, over a length of 300 meters, in the joint area between foundation and elevation.**
- **erosion of river banks where the watercourse changed its flowing direction;**
- **access route to 15 households in the village;**
- **70 meters of road infrastructure.**

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DEGRADATIONS OCCURRED IN THE STUDIED AREA DUE TO A RAPIDLY INCREASING WATER FLOW

SOLUTIONS FOR HARNESSING SMALL WATERCOURSES

- **continuous works along the bank, coating it - direct protection;**
- **safety of buildings in the area;**
- **create steady banks on the stream bed.**

SOLUTIONS FOR HARNESSING SMALL WATERCOURSES

To fix and to prevent further degradations of the riverbanks a series of works were proposed:

- **repositioning of the public water supply pipe with a diameter of 90 mm;**
- **to protect the left bank of the stream G 1.5 gabion boxes were made and paved with cement concrete; the boxes were placed on a S 0.5 gabion mattress;**
- **road rehabilitation on the affected area;**
- **an access route was carried out downstream the gabion boxes to allow passage, through the riverbed, to the households on the right side of the stream;**
- **to minimize the impact of water on the left bank of the spring, the bed will be rebuild in that specific area, by reducing its radius of curvature.**

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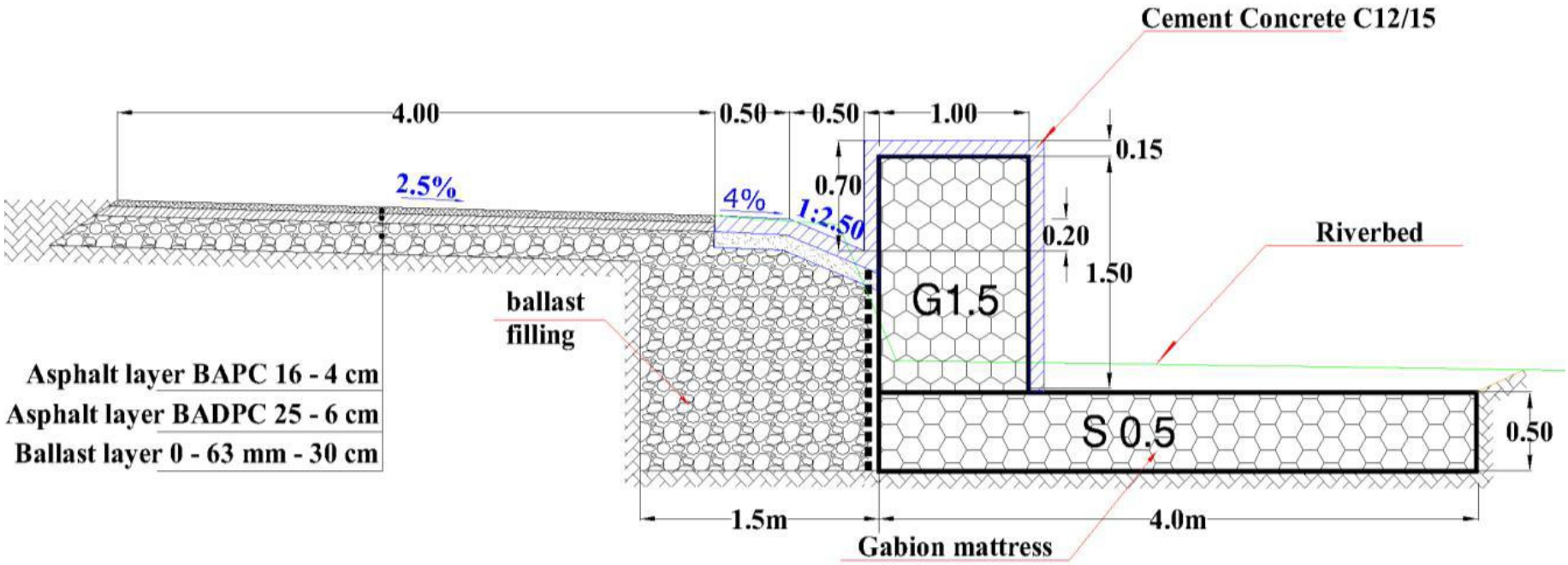
SOLUTIONS FOR HARNESSING SMALL WATERCOURSES

Section through the riverbank improvement on Valea Mare stream



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SOLUTIONS FOR HARNESSING SMALL WATERCOURSES

The area affected by the flow of water from torrential rains, after the execution of watercourse improvement works

CONCLUSIONS

- **Relief and climate presents a major role in establishing supplying and flowing conditions in small watercourses.**

- **Streams located in the temperate climate, can present sudden water flow increases, leading to overflow. This phenomenon has a negative impact on the surrounding areas.**

- **Improper arrangement of stream banks leads to soil erosion and, in time, to slope instability, through scour or erosion of riverbank base.**

CONCLUSIONS

- **In the presented case study, for watercourse harnessing was used a classic improvement solution that consists of gabion mattresses and boxes. This solution was adopted considering the fact that the material was available on site, the gabions have high elasticity and are easy to manufacture.**

- **Flood prevention on small watercourses is an issue that should be considered. In Romania every year these waters exit from their riverbed and produce loss of human lives and significant material damage.**