Water Rennovation in Ukraine
Project no. 22320101

Water Rennovation in Ukraine

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The project is co-financed by the Governments of the Czechia, Hungary, Poland and Slovakia through Visegrad Grants from International Visegrad Fund. The mission of the fund is to advance ideas for sustainable regional cooperation in Central Europe.

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Torrent control

Tatiana Kaletova

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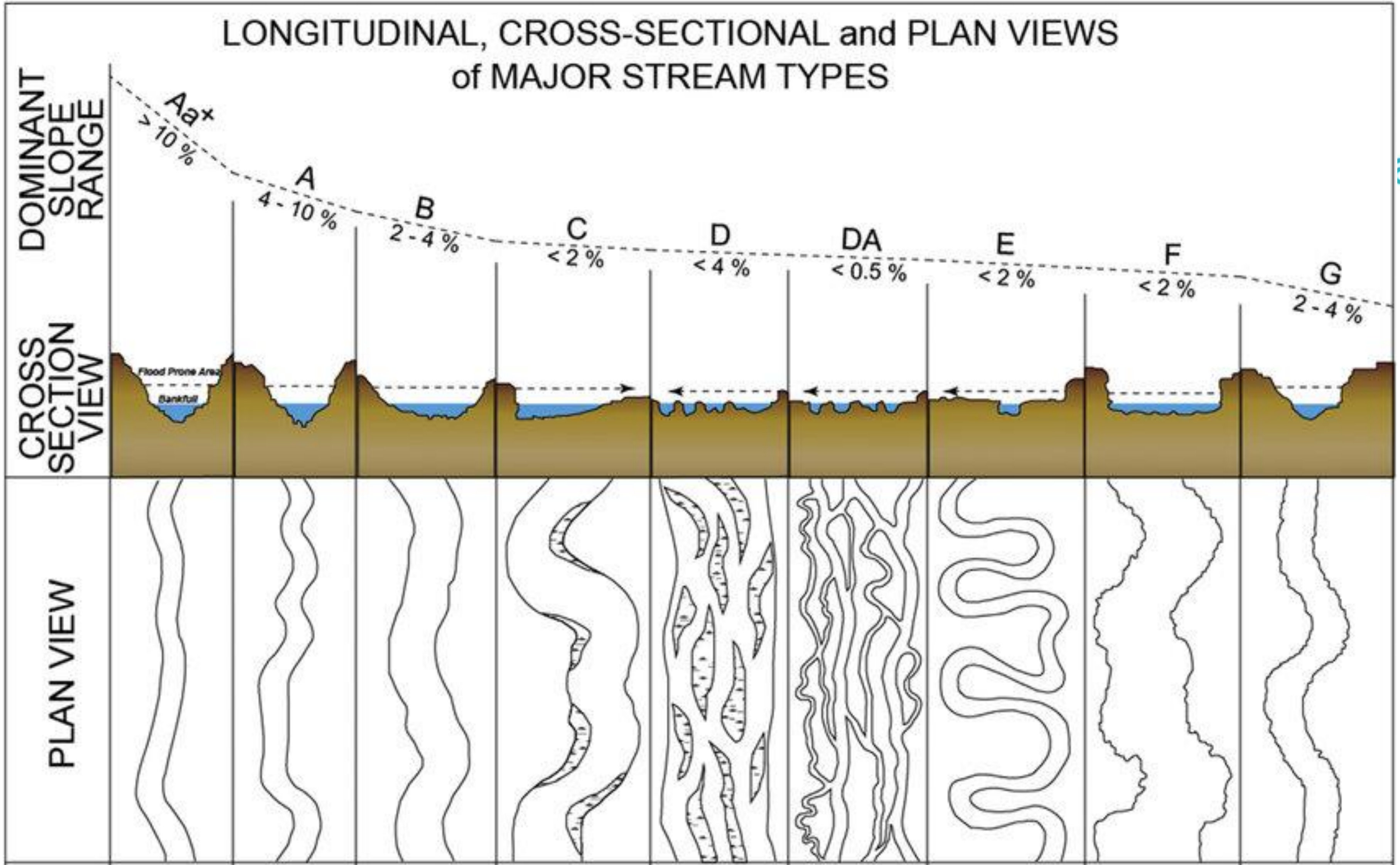

STREAM TYPES	Aa+	A	B	C	D	DA	E	F	G
SIN.	< 1.2		> 1.2	> 1.4	< 1.1	1.1 - 1.6	> 1.5	> 1.4	> 12
W/D	< 12		> 12	> 12	< 40	< 40	> 12	> 12	< 12
SLOPE (degree)	0.04-0.099		0.2-0.039	< 0.2	< 0.02	< 0.005	< 0.02	< 0.02	0.2-0.39
	Straight		Low Sinuosity	Meandering	Braided	Anastomosed	Stable Meandering	Entrenched Meandering	Gullies

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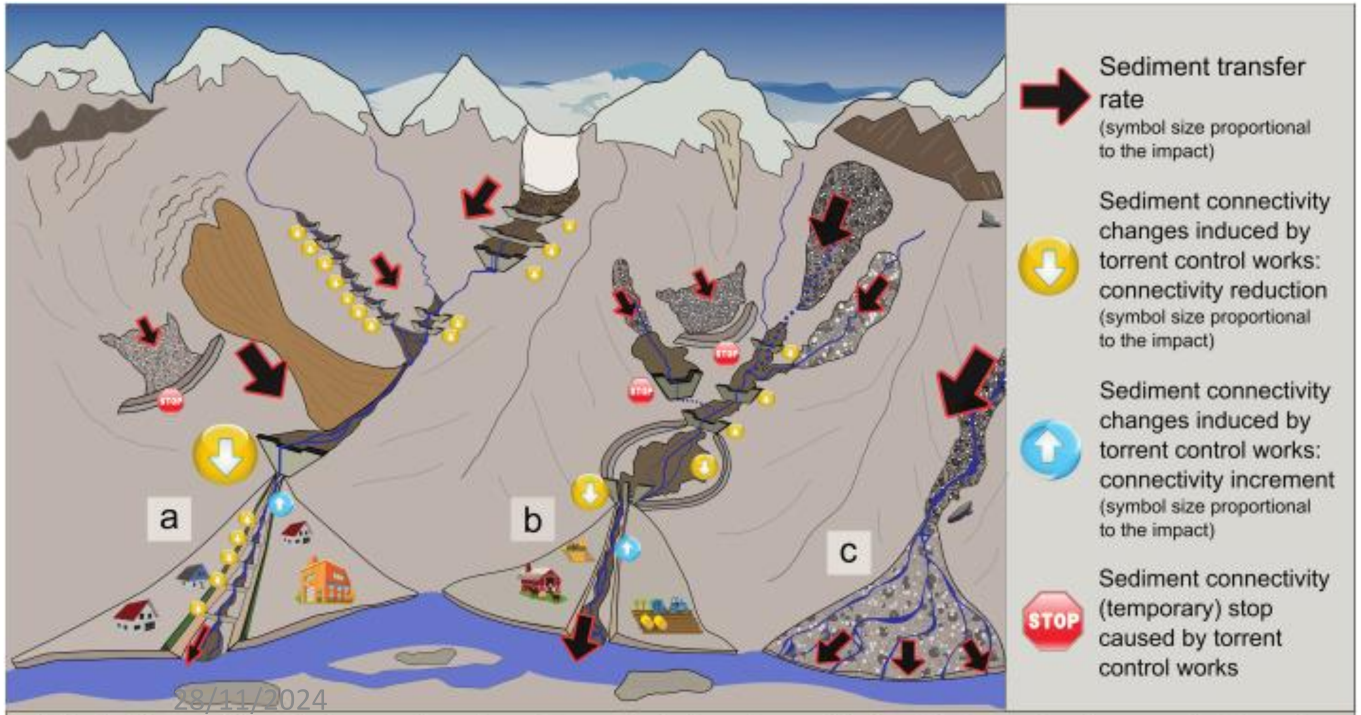
Rosgen, L. D., 1994

Torrent

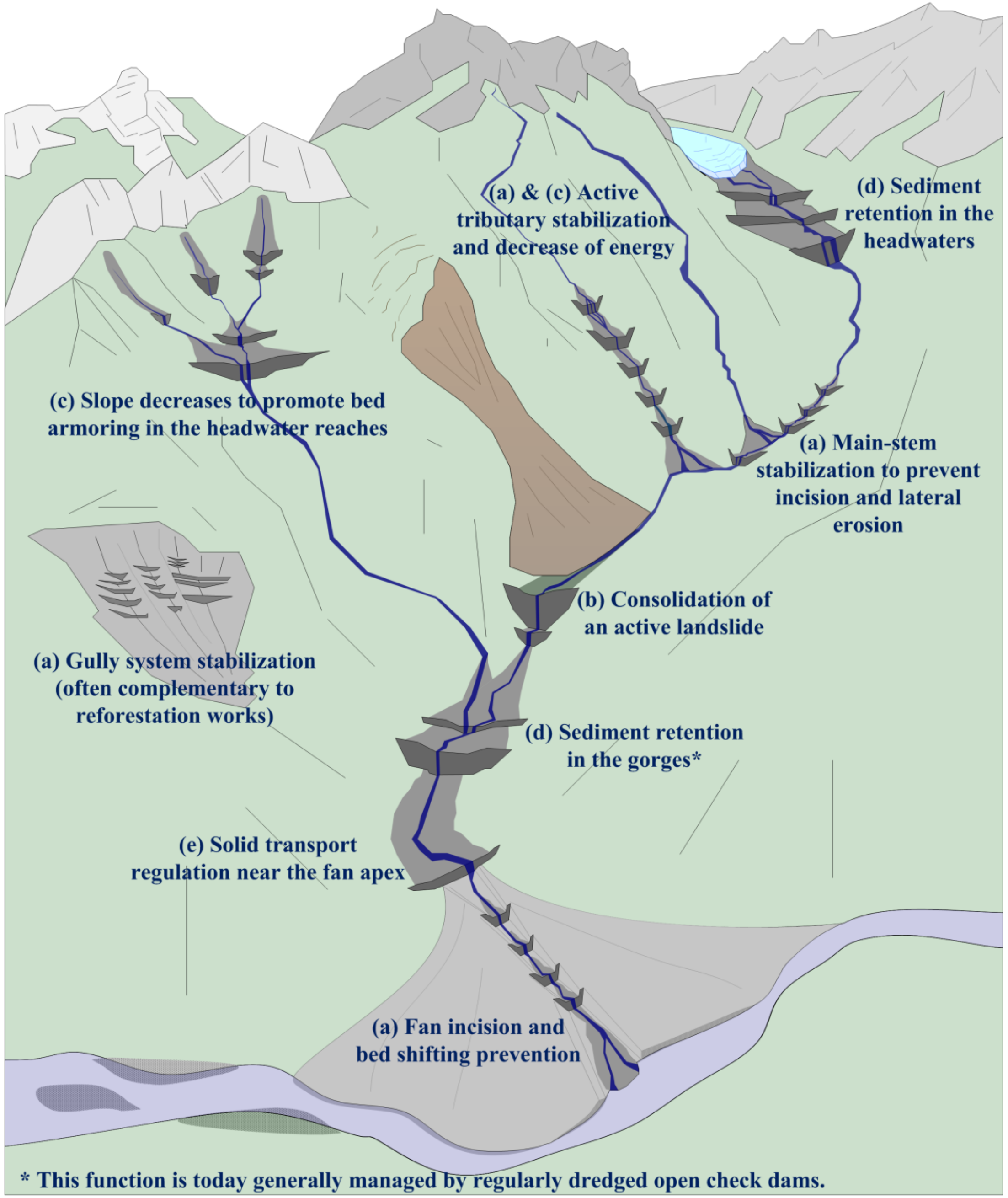
- a water-course category defined as a stream with highly variable discharges, high slope gradients of the bottom, high scouring activity, transport, and deposition of sediment and frequent changes of channel dimensions, the main criterion being the formation, transport and deposition of sediment
- the variation of the discharges, that is, the ratio between the minimum and maximum discharges, may be as wide as 1:5000 or even wider
- abrupt changes in torrent discharges usually occur during flood rains following a long-wet period when the soil in the watershed no longer has sufficient capacity to absorb the flood rainwater
- characteristic feature of torrents is that their discharge grows rapidly to reach a maximum and subsequently drops again equally rapidly - torrents have small watersheds, so high rainfalls usually affect the whole watershed area. With the high inclination of the ground, the surface runoff rapidly concentrates in the channel and can reach the lower segments of the torrent during the rainfall
- the key criterion of the “torrent” nature of the stream is its scouring activity by which gravel sediment is released and transported downstream. The sources of sediment include the torrent channel itself, and the deposits of gravel carried thereto from the steep slopes of the valleys exposed to erosion and from tributary ravines

Torrent

- The sources of sediment include
  - the torrent channel itself
  - gravel deposits from the steep slopes of the valleys exposed to erosion
  - from tributary ravines

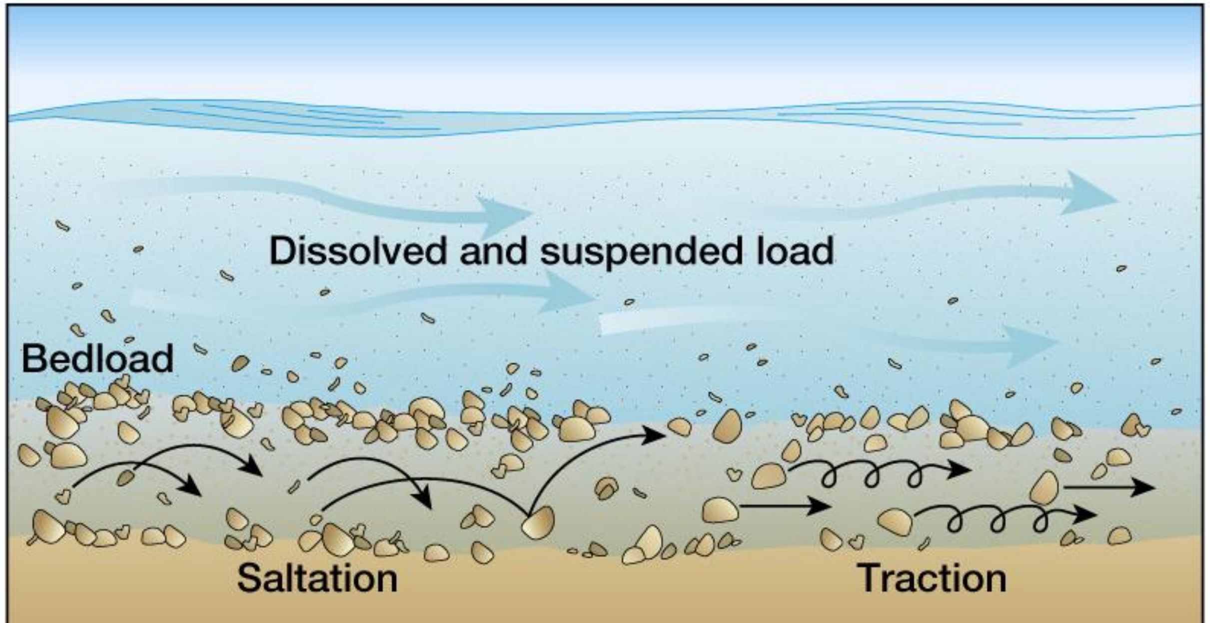


Alluvial fan: a) lined channel and grade-control structures; b) lined channel; c) no control works

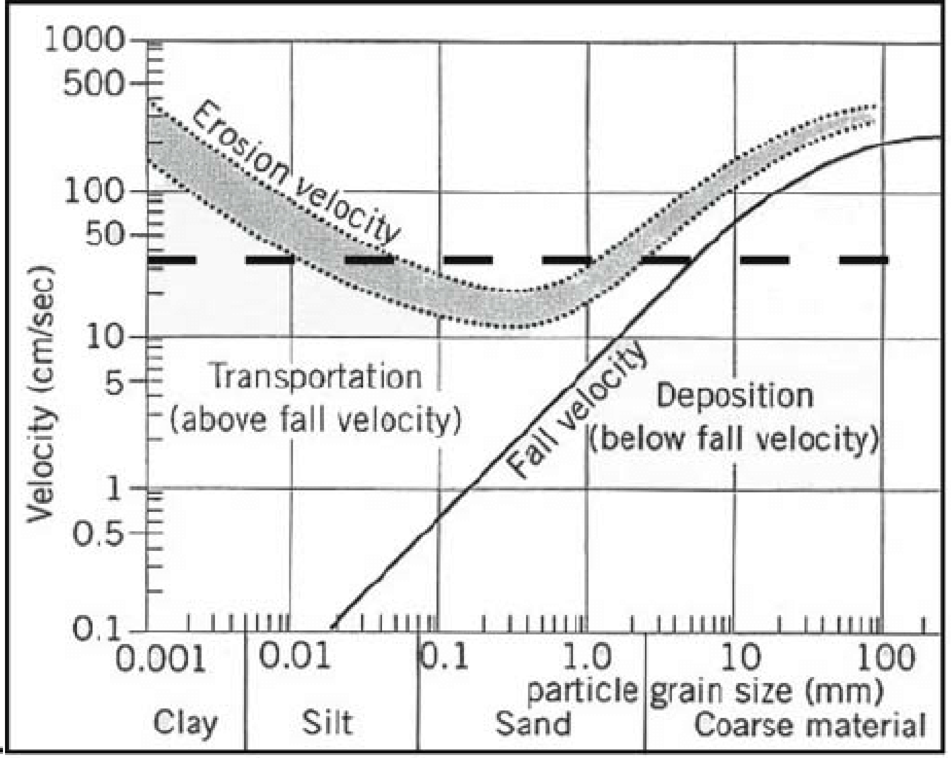


←Marchi, L., et al., 2019

↑Piton, G., 2016



https://www.austintexas.gov/sites/default/files/files/Water/CER/river_life_ecology_of_flowing_water_june_2015.pdf



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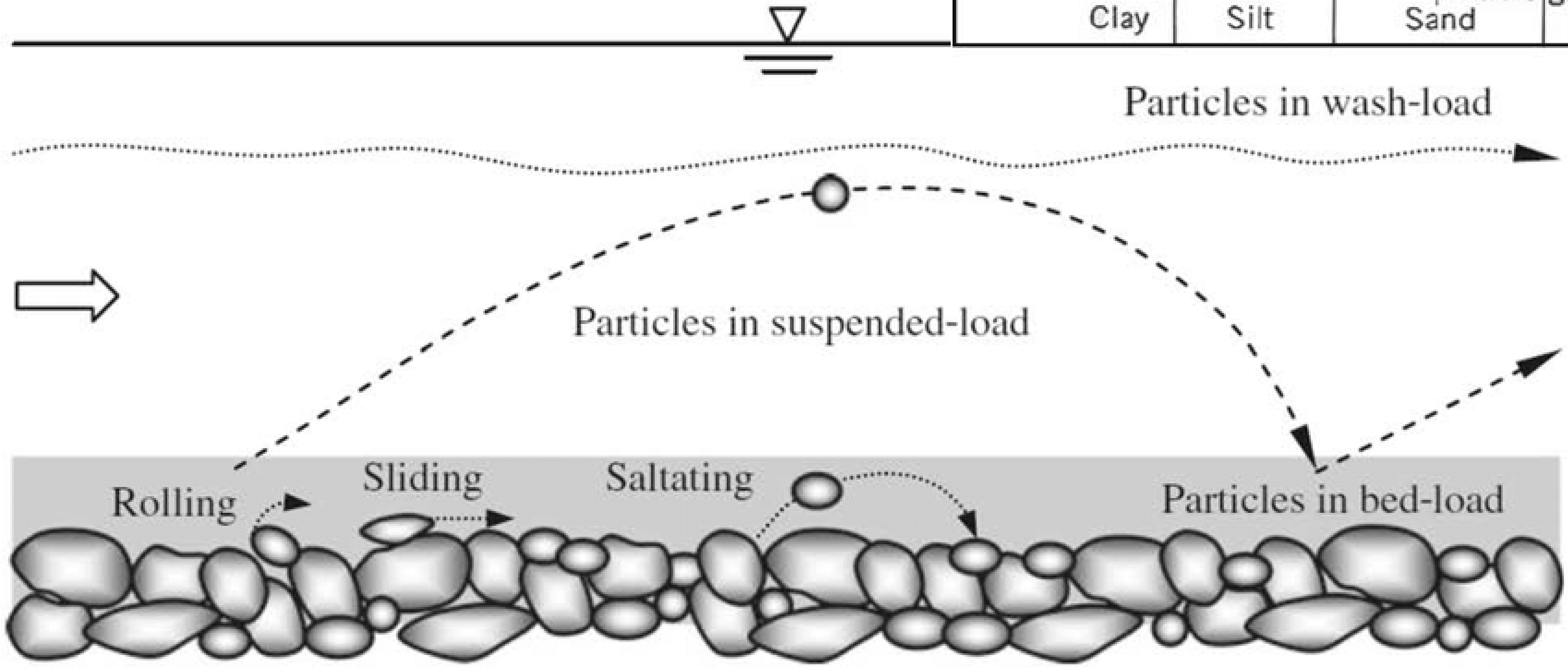
Puscas, C.M., Stremtan, C.C., Krisály, F., 2010



Dey, S., 2014

Erosion Potential Method (EPM)

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- The EPM erosion mapping procedure requires investigations and computations to determine and present on a map the surfaces with the same quantitative erosion class
- The basic EPM value of the quantitative erosion intensity is the Erosion Coefficient (Z)
- The quantitative value of the (Z) has been used to separate erosion intensity to classes or categories. The mean value of the EPM erosion coefficient for the catchment's area is the basics value for all EPM calculations.

EPM Erosion and torrent categorization			Table 1
Erosion and torrent category	Qualitative name of erosion category	Range of values of coefficient (Z)	Mean value of coefficient (Z)
I	Excessive erosion - deep erosion process (gullies, rills rockslides and similar)	Z > 1.0	Z=1.25
II	Heavy erosion - milder forms of excessive erosion	0.71< Z <1.0	Z=0.85
III	Medium erosion	0.41<Z<0.7	Z=0.55
IV	Slight erosion	0.20<Z<0.4	Z=0.30
V	Very slight erosion	Z< 0.19	Z=0.10

Gavrilovic, Z. et al., 2008

Torrential class

- The basic idea of this module is to enable the assessment of torrential characteristics by one glance. This is made possible by the introduction of the entry called “Torrent Formula“. The formula consists of three parts, i.e.:
  - Torrential class
  - Torrential category
  - Erosion intensity.

Gavrilovic, Z. et al., 2008

Torrential class

- based on the value of hydro graphic coefficient of the torrential class (Hk)

Torrent classification		Table 2
Torrent class	Description	Torrent hydrographic class coefficient (Hk)
A	Torrent Rivers	Hk>20
B	Small torrent Rivers	10<Hk<20
C	Torrent streams	1.0<Hk<10
D	Small temporary torrent streams	0.1<Hk<1.0
E	Landslide small torrents	0.05<Hk<0.1
F	Gullies	Hk<0.05

Gavrilovic, Z. et al., 2008

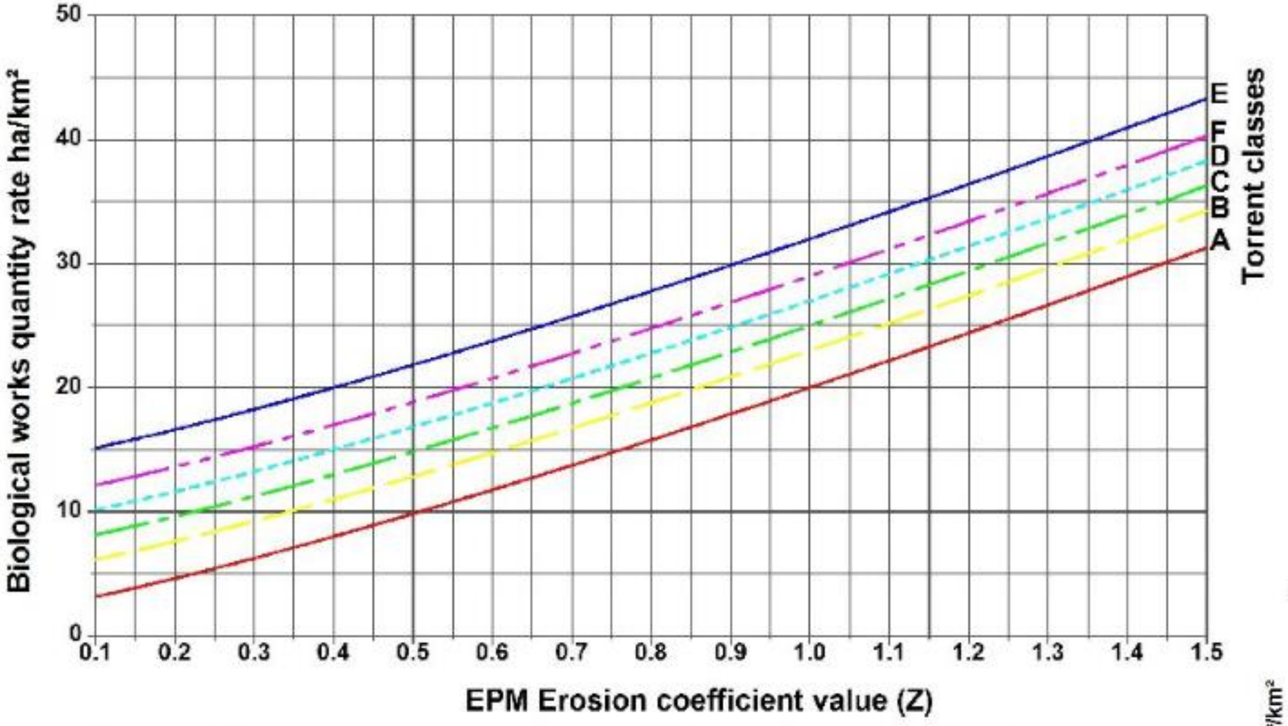
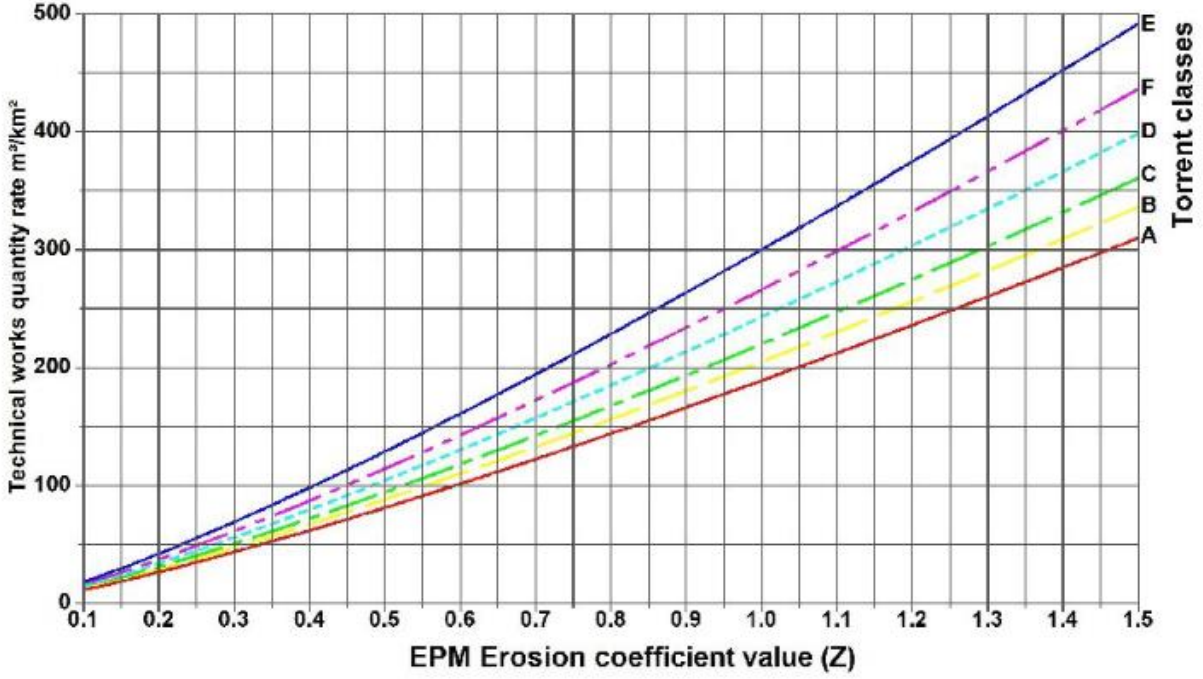


Figure 1. Relations between erosion coefficient and biological works quantity rate



Gavrilovic, Z. et al., 2008

Figure 2. Relations between erosion coefficient and technical works quantity rate

Transverse torrent control structures (TTCS)

- *check dams*: structures that control the sediment dynamics inside the watercourse by stabilising the transverse profiles of torrential bed, by consolidating the longitudinal bed (reducing the bed slope and the velocity of torrential water flood, and because of sediment transport), by sorting or dosing the sediment transport rate, by retaining the bed load in their storage area and by breaking of debris flow
- *(ground and submerged) sills*: structures designed to stabilise the channel and prevent bed erosion
- *bed protection structures*: interventions designed to consolidate the surface layer of the channel bed and to prevent erosion and sediment mobilisation
- *groynes*: deflectors that skilfully divert the flowing water away from the streambank and limiting the sediment movement

Cislaghi, A. et al., 2024

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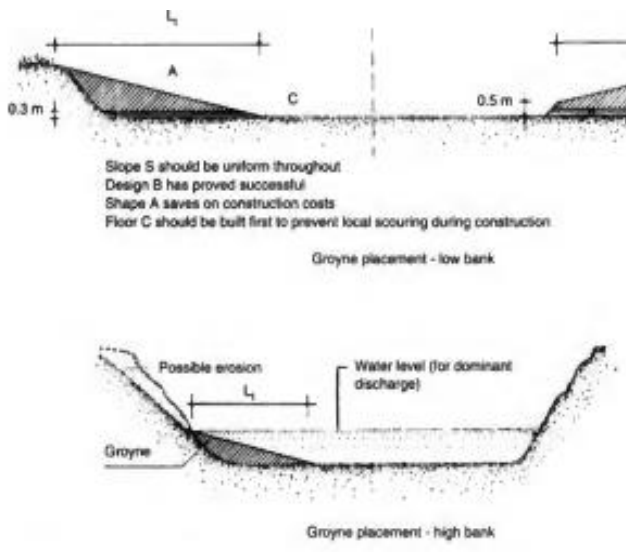

Figure 58. Height and slope of a groyne crest

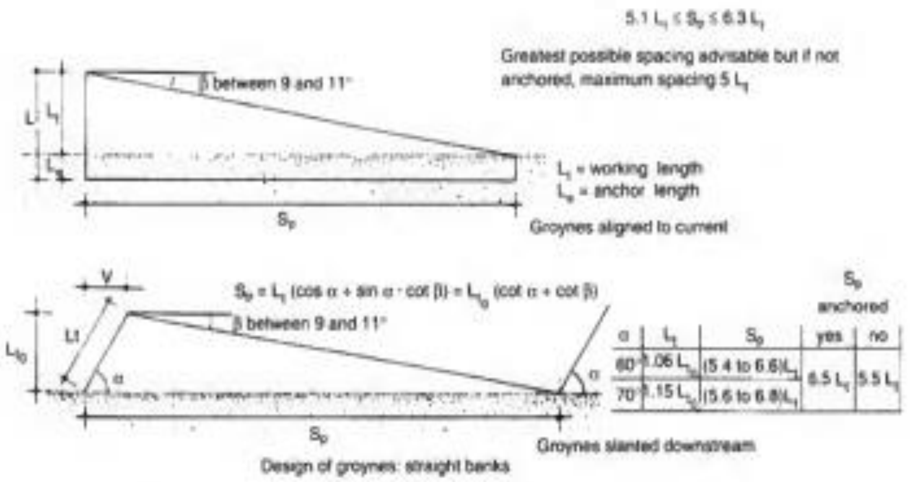

Figure 56. Detail of groyne design

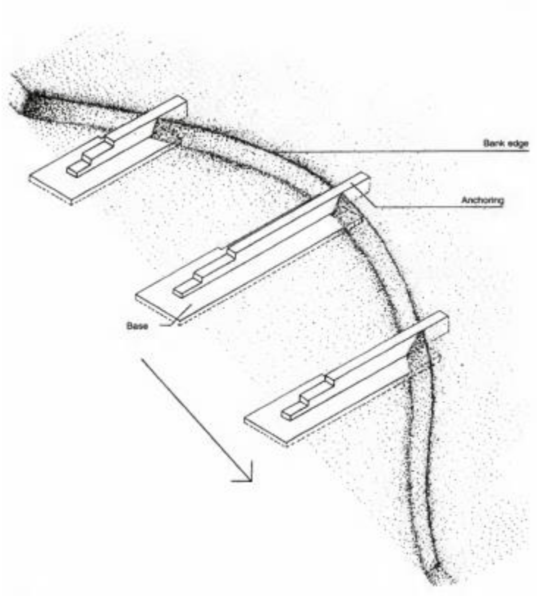

Figure 59. Series of gabion groynes on a gabion base along an eroded bank

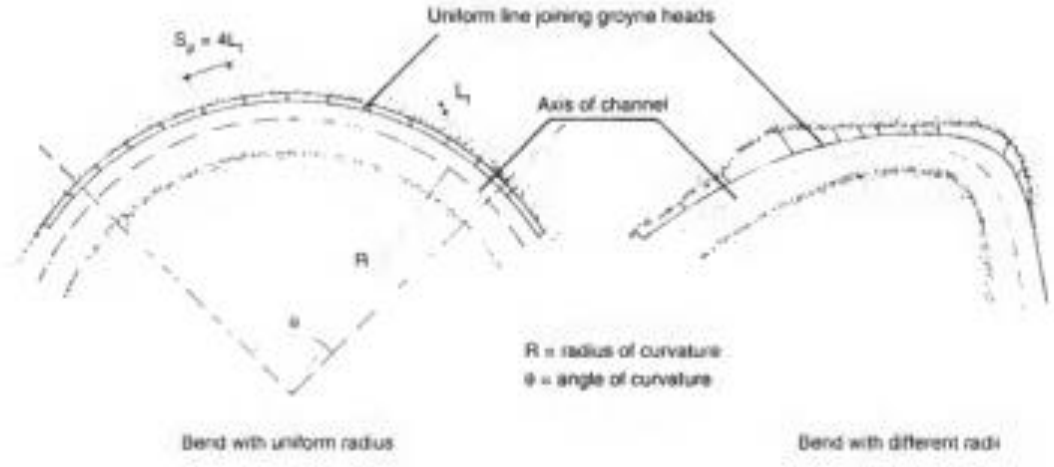

Figure 55. Groyne design: various types of location in plan

López Cadenas de Llano, F., 1993

Google maps, 2017

Transverse torrent control structures (TTCS)

Description of primary function and common dysfunctionality in function of the TTCSs

Type of TTCSs	Primary function	Dysfunctionality
Check dam	Stabilisation	Streamflow bypasses the spillway.
		Streamflow outflanks the structure.
		Bed erosion.
	Consolidation	Streamflow bypasses the spillway.
		Streamflow outflanks the structure.
		Excessive erosion.
	Sediment retention	Deposition space is filled.
Sills	Bed stabilisation	Excessive deposition.
		Excessive erosion.
Bed protection structure	Bed stabilisation	Bed erosion.
		Excessive deposition.
Groynes	Streambank stabilisation	Streamflow bypasses the element.
		Streambank erosion.

Cislaghi, A. et al., 2024

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Thank you for your attention.

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