

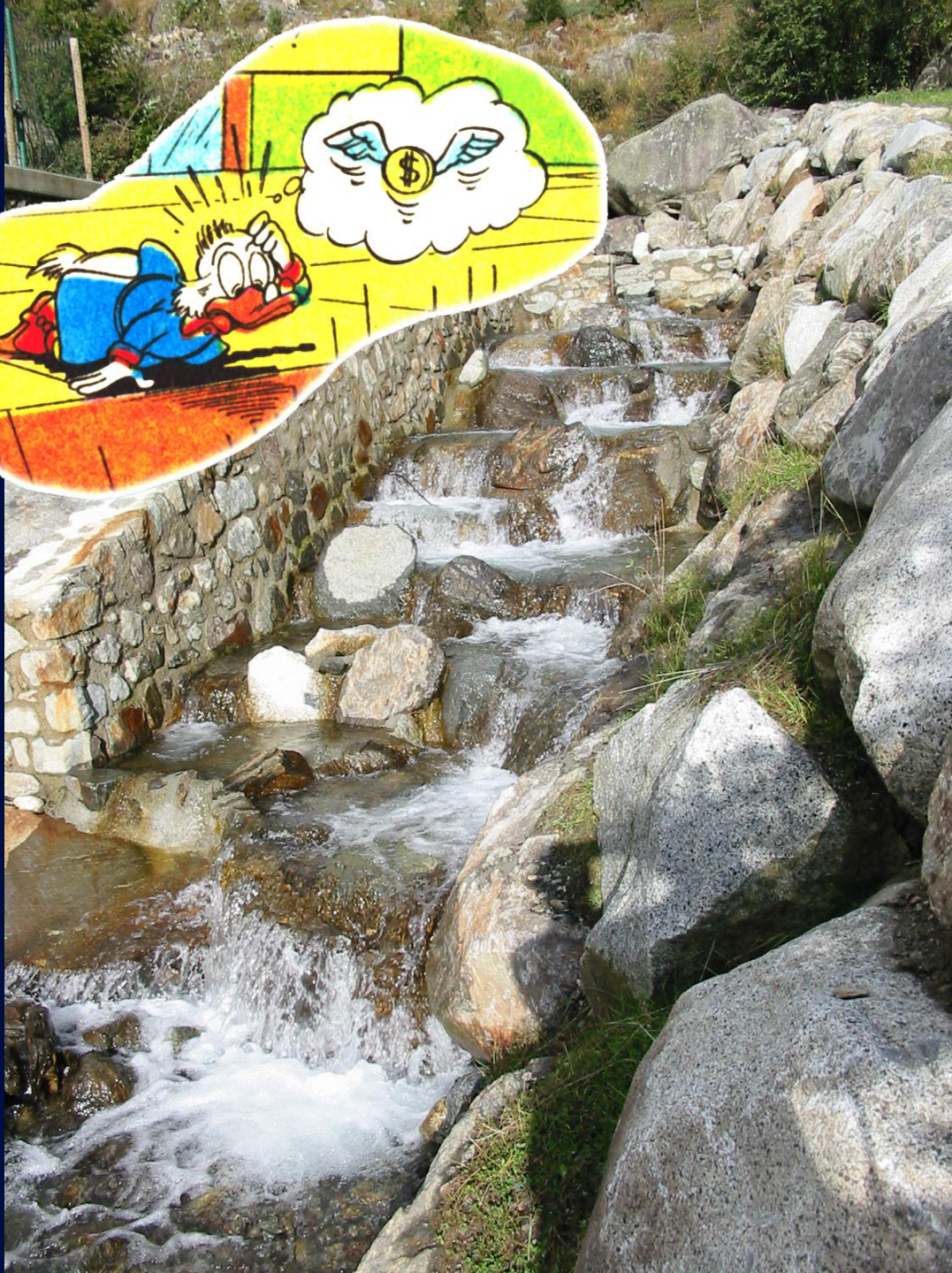


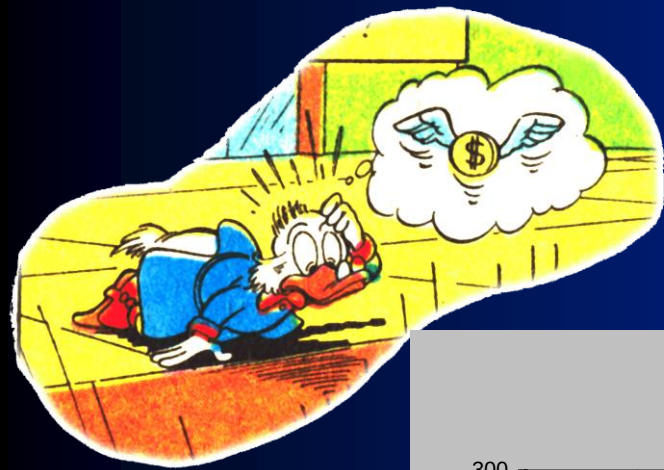
RESERVED FLOW: FROM AN OBLIGATION TO AN OPPORTUNITY

Luigi Papetti

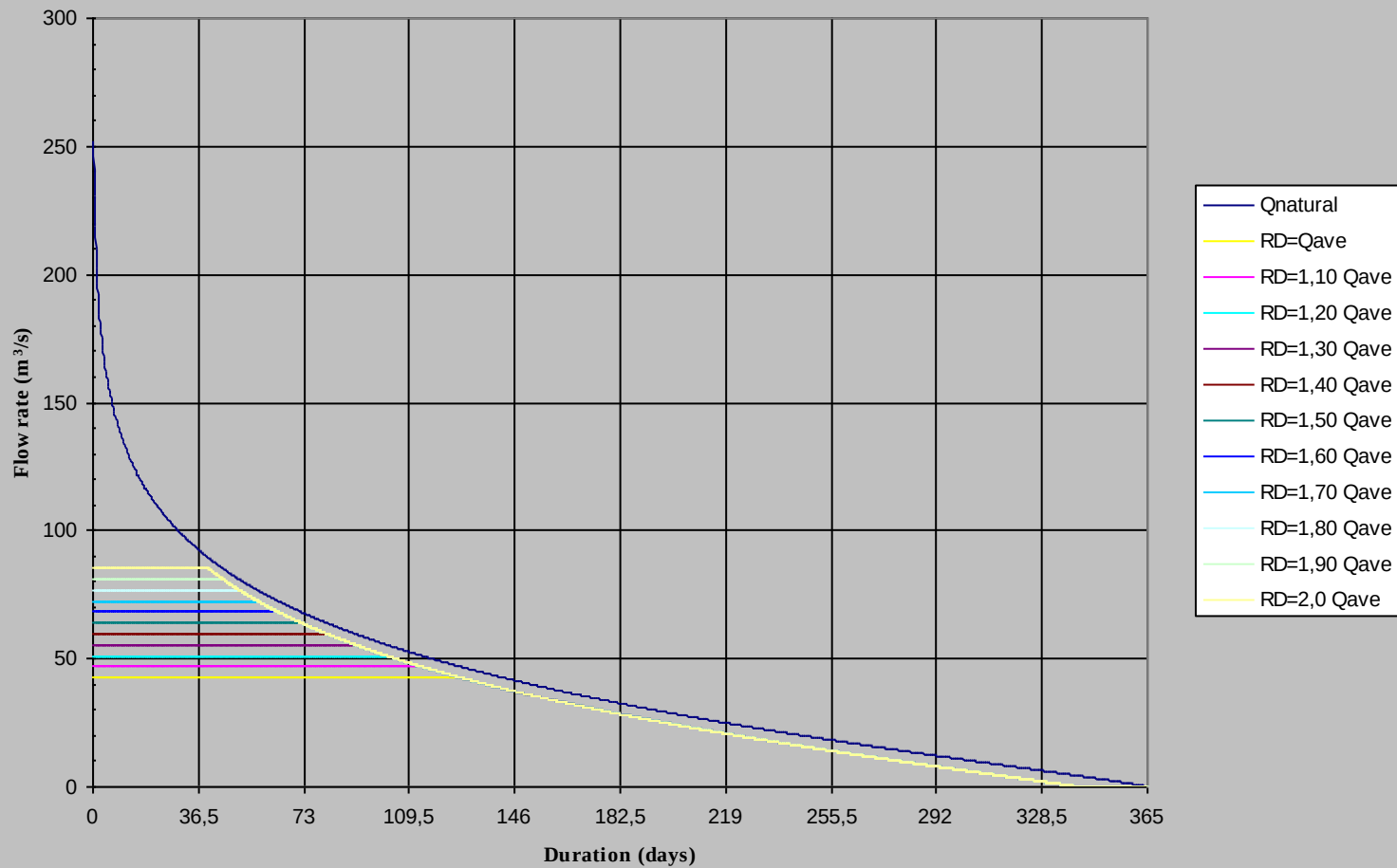
Studio Frosio - Brescia

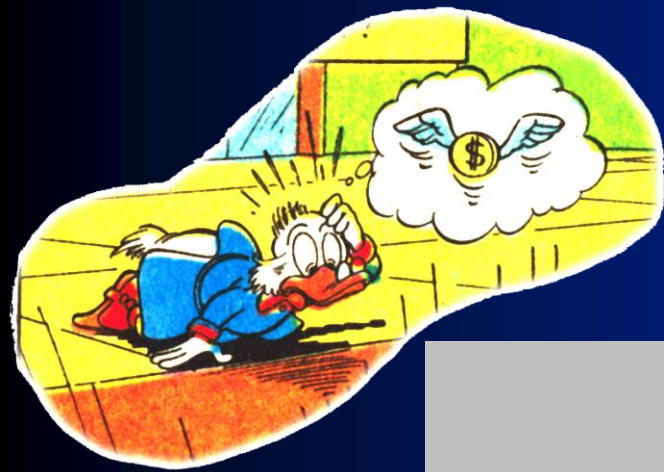
Italy



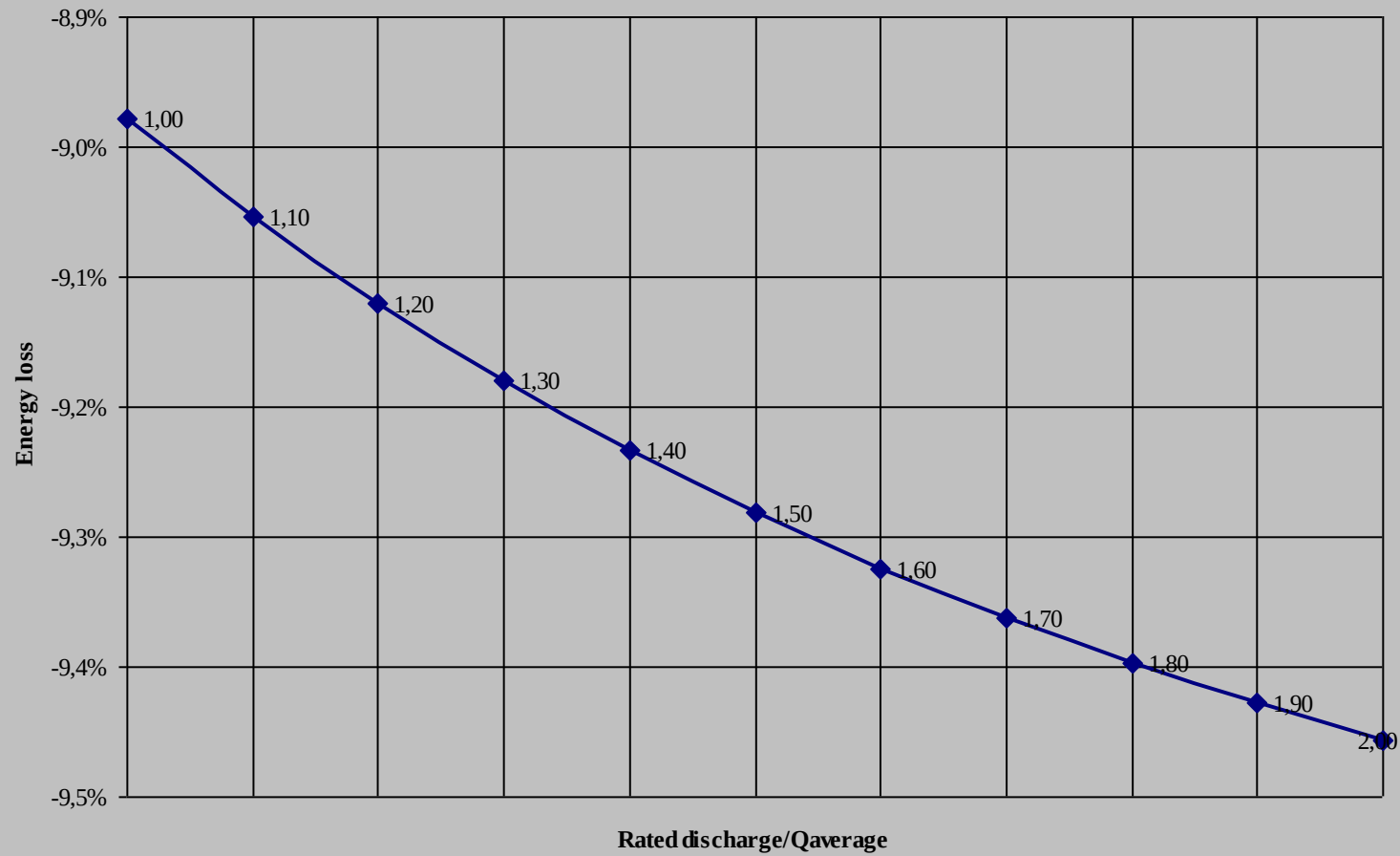


FDC for different rated discharges in case of 10 % Q_{ave} Reseved Flow





Energy loss in case of 10% Q_{average} Reserved Flow

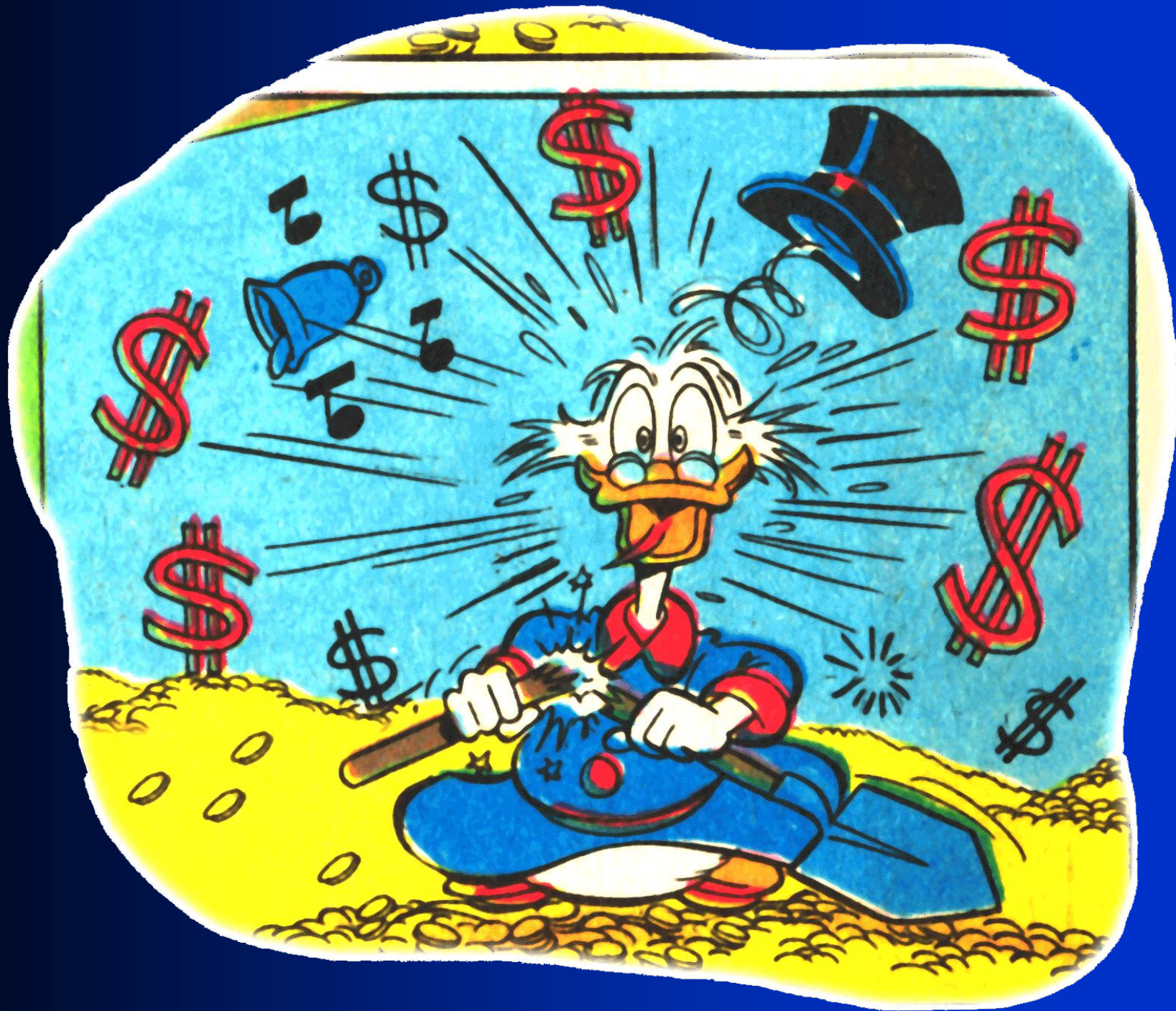


What do I need for hydro energy production?

- Flow
 - = Reserved flow – fish passage flow rate
- Head
 - = WL difference at the dam or weir

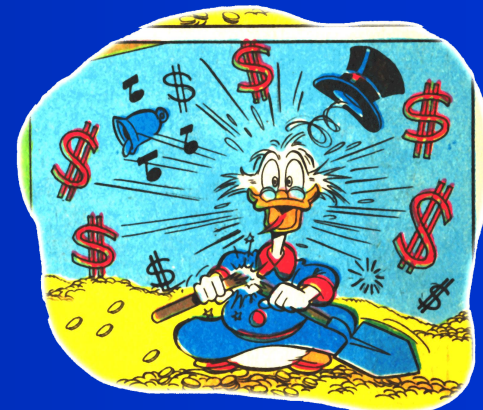


To exploit the residual *Flow* to produce hydroelectric energy if a *Head* is available



Main typologies

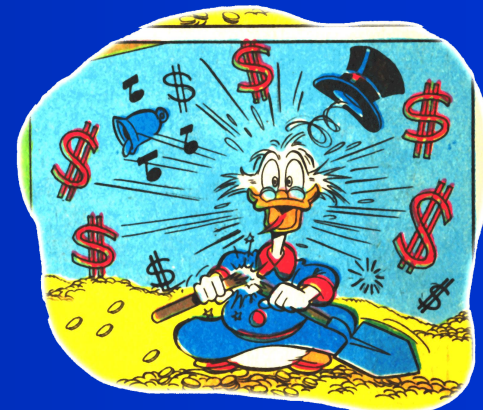
- 1) Low head, large flow (weirs) [greater part]
- 2) High head, low flow (dams)



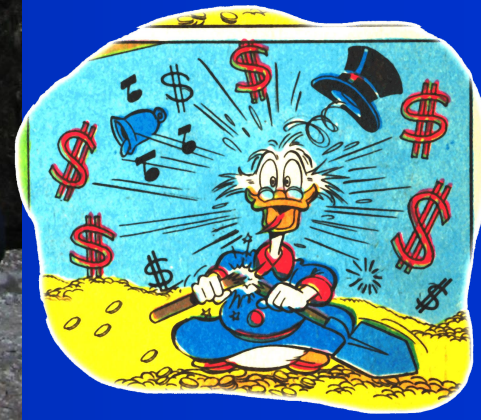
APPLICATIONS – TYPOLOGY 2

SANTA GIUSTINA DAM

•Minimum head	60	m
•Maximum head	128	m
•Rated discharge (constant)	2,10	m ³ /s
•Installed capacity	2.500	kW
•Expected production	14	GWh/yr



APPLICATIONS – TYPOLOGY 2



APPLICATIONS – TYPOLOGY 2



APPLICATIONS – TYPOLOGY 2

Mollaro Dam

- Minimum head 20 m
- Maximum head 30 m
- Rated discharge (constant) 2,40 m³/s
- Installed capacity 700 kW
- Expected production 4,0 GWh/yr



APPLICATIONS – TYPOLOGY 2



APPLICATIONS – TYPOLOGY 2



APPLICATIONS – TYPOLOGY 1

Chievo Weir on Adige River

- Average gross head 3,80 m
- Average net head 3,30 m
- Rated discharge (constant) 60 m³/s
- Installed capacity 1.450 kW
- Expected production 12 GWh/yr



APPLICATIONS – TYPOLOGY 1



APPLICATIONS – TYPOLOGY 1



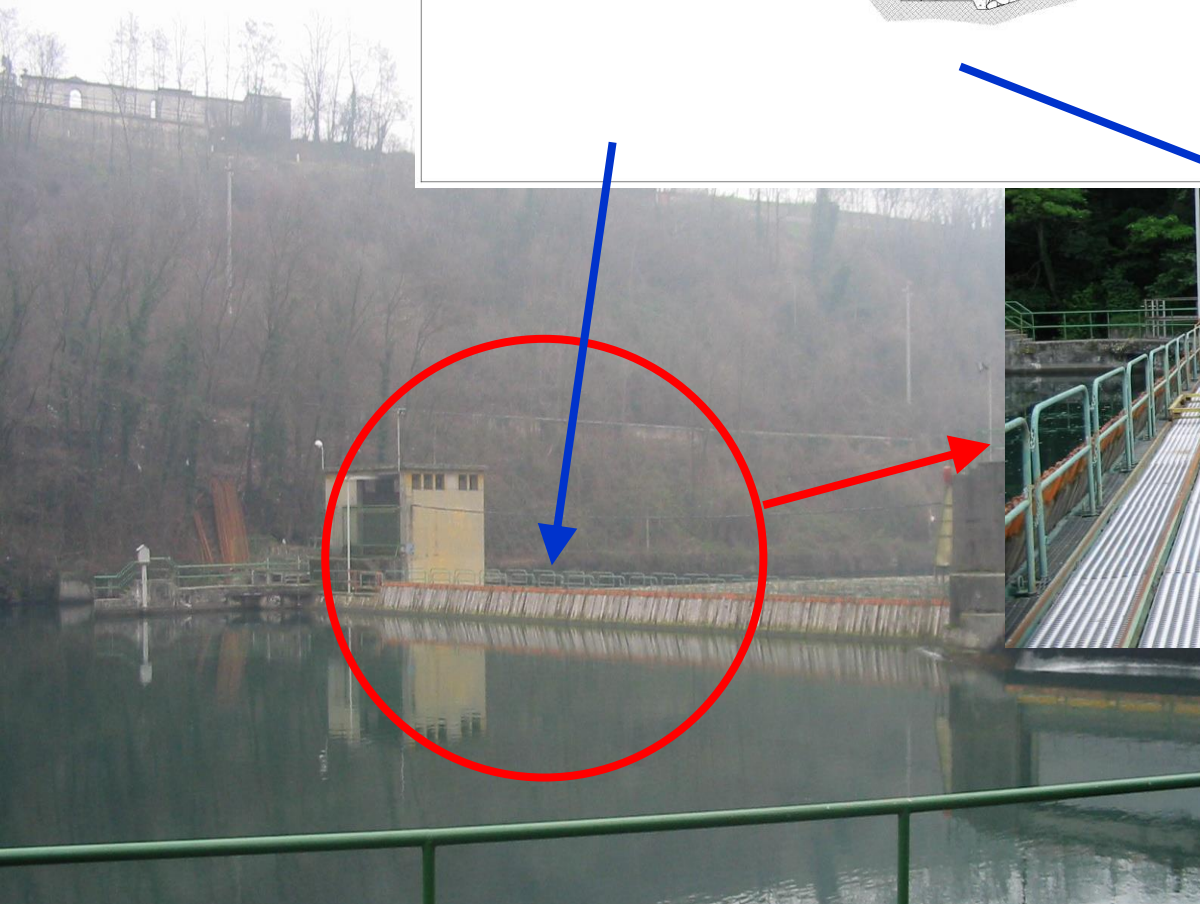
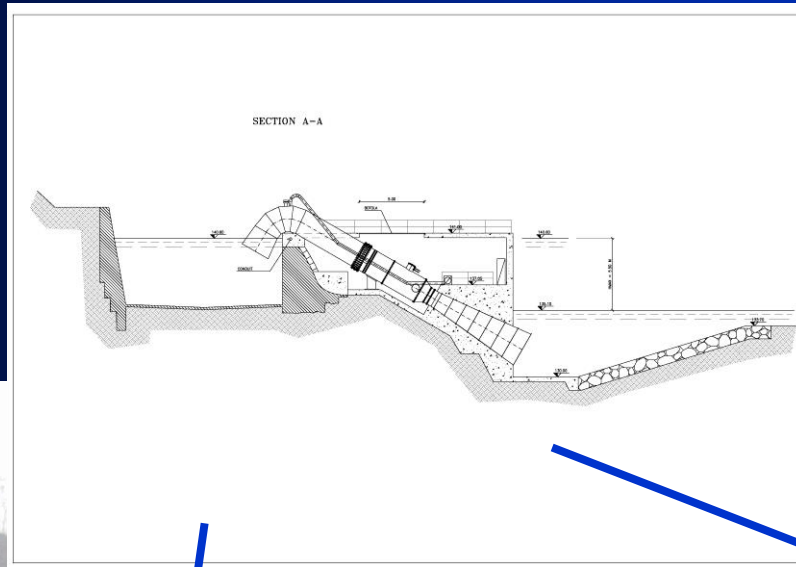
APPLICATIONS – TYPOLOGY 1

CONCESA WEIR ON ADDA RIVER

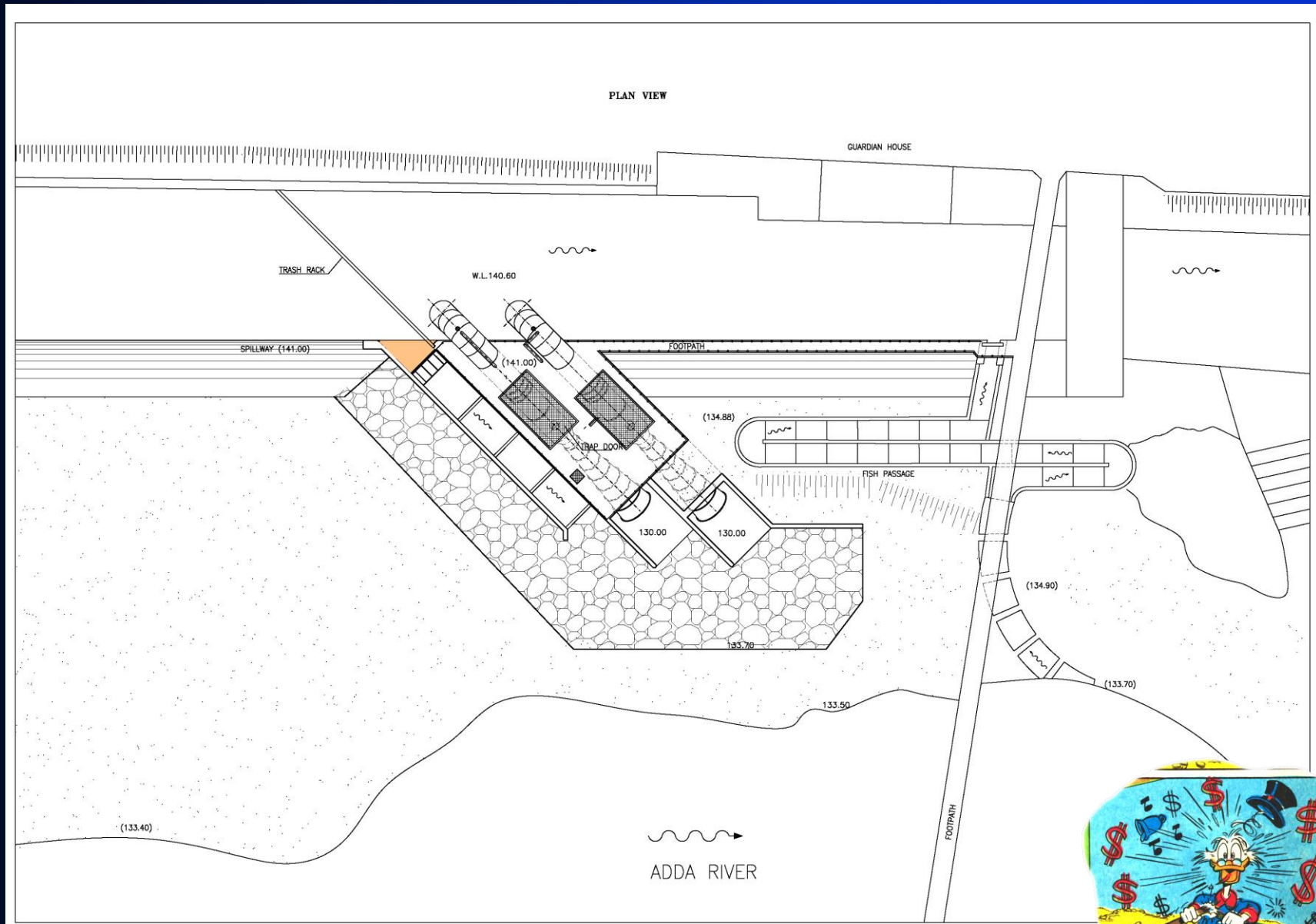
- Average head 4 m
- Rated discharge (constant) 14,0 m³/s
- Installed capacity 500 kW
- Expected production 4,0 GWh/yr



APPLICATIONS – TYPOLOGY 1

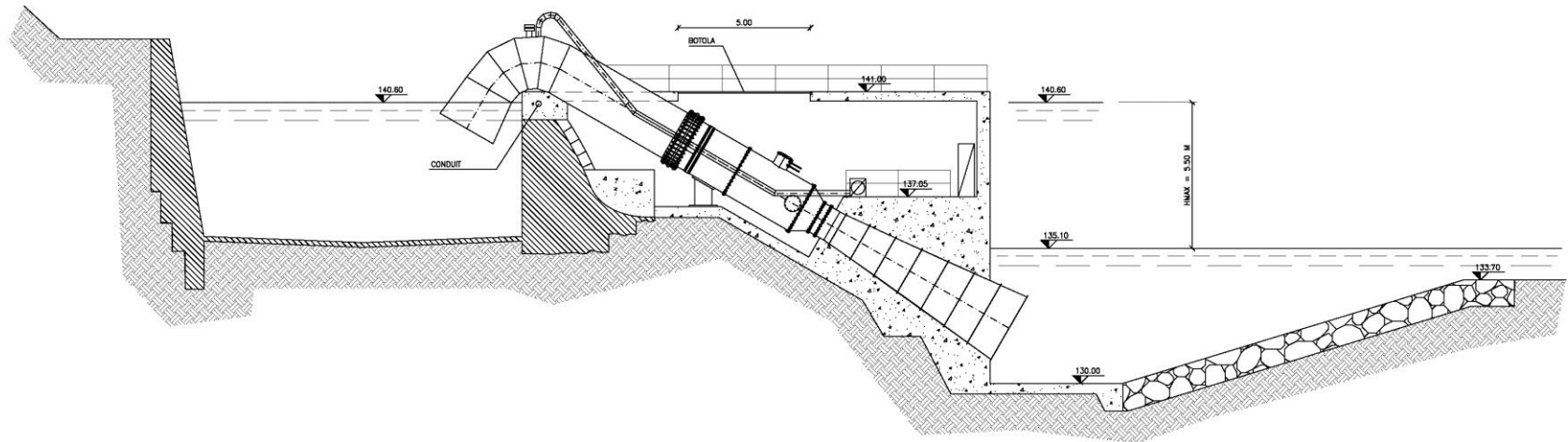


APPLICATIONS – TYPOLOGY 1



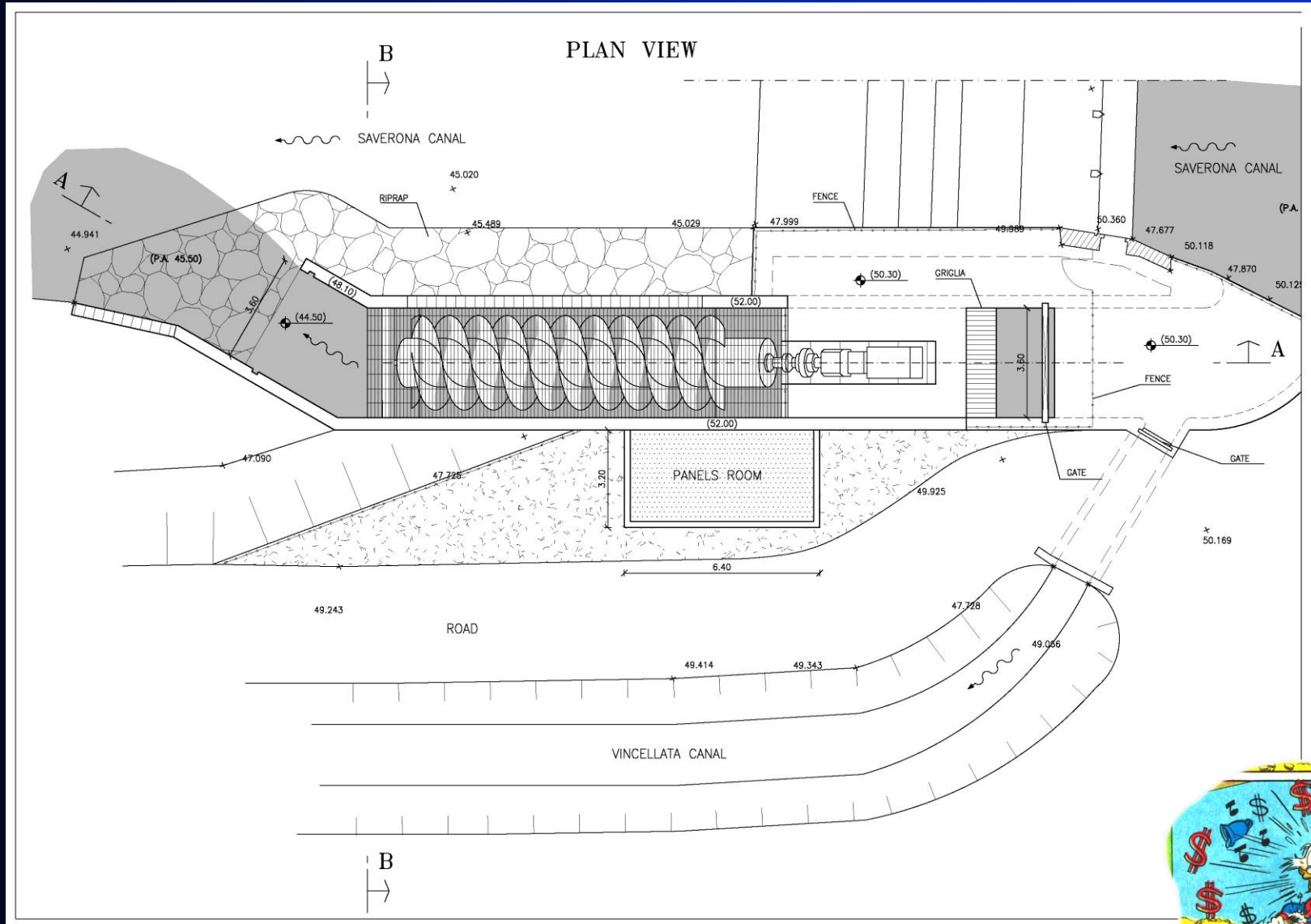
APPLICATIONS – TYPOLOGY 1

SECTION A-A



APPLICATIONS – TYPOLOGY 1

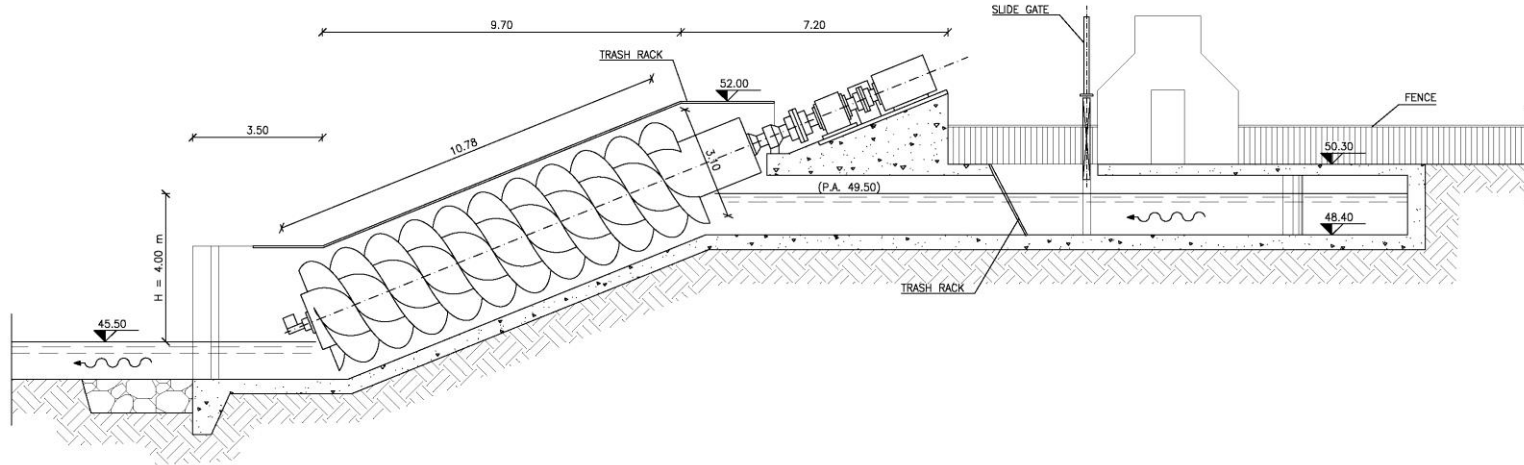
LATEST NEWS



APPLICATIONS – TYPOLOGY 1

LATEST NEWS

SECTION A-A



WHAT ABOUT MONEY?



Plant	Energy value [€/MWh]	Income [€/yr]	Investment [€]	Payback [years]
Santa Giustina	155	2.170.000	4.700.000	2,4
Mollaro	170	680.000	4.200.000	6,9
Chievo	155	1.860.000	6.000.000	3,6
San Liberato	155	1.400.000	NA	NA
Concesa	170	680.000	1.500.000	2,5

CONCLUSIONS

- from a heavy obligation to an interesting opportunity: mission possible
- the highest possible level of compromise between SHPs and environmental requirements
- maximum environmental profit as they produce highly valuable renewable energy without any remarkable alteration in the natural ecosystem (multipurpose use of water)



THE END