NO-DIG TECHNOLOGY AS A PREVENTION FOR ENVIRONMENTALLY HAZARDOUS LANDSLIDES

Case story in Ercsi/Hungary

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General information on geotechnical situation, main reasons what cause landslides in Hungary

- There were enormous intensive rainy periods in Hungary in the years 1999-2000.
- Serious landslides occured on several riverbanks where different clay, loess, silt, medium/fine sand layers settled in a slight slope to the rivers.
- In normal conditions (average rainfall) the outflow capacity of the permeable soil layers in these riverbank areas is equal or less, than the quantity of the streaming groundwater.
- In this case the whole sandwich-like composite soil structure is in stabil, safe position.
- In some cases the supply of the streaming groundwater - in the permeable soil layer - increases enormously (e.g. leaking public service lines, extreme rainfall etc.), or the normal outflow of the steraming grondwater had been hindered/blocked……

The result: …..Landslides…..

Fig. No. 1.

Middle water level river, riverbank in stable position

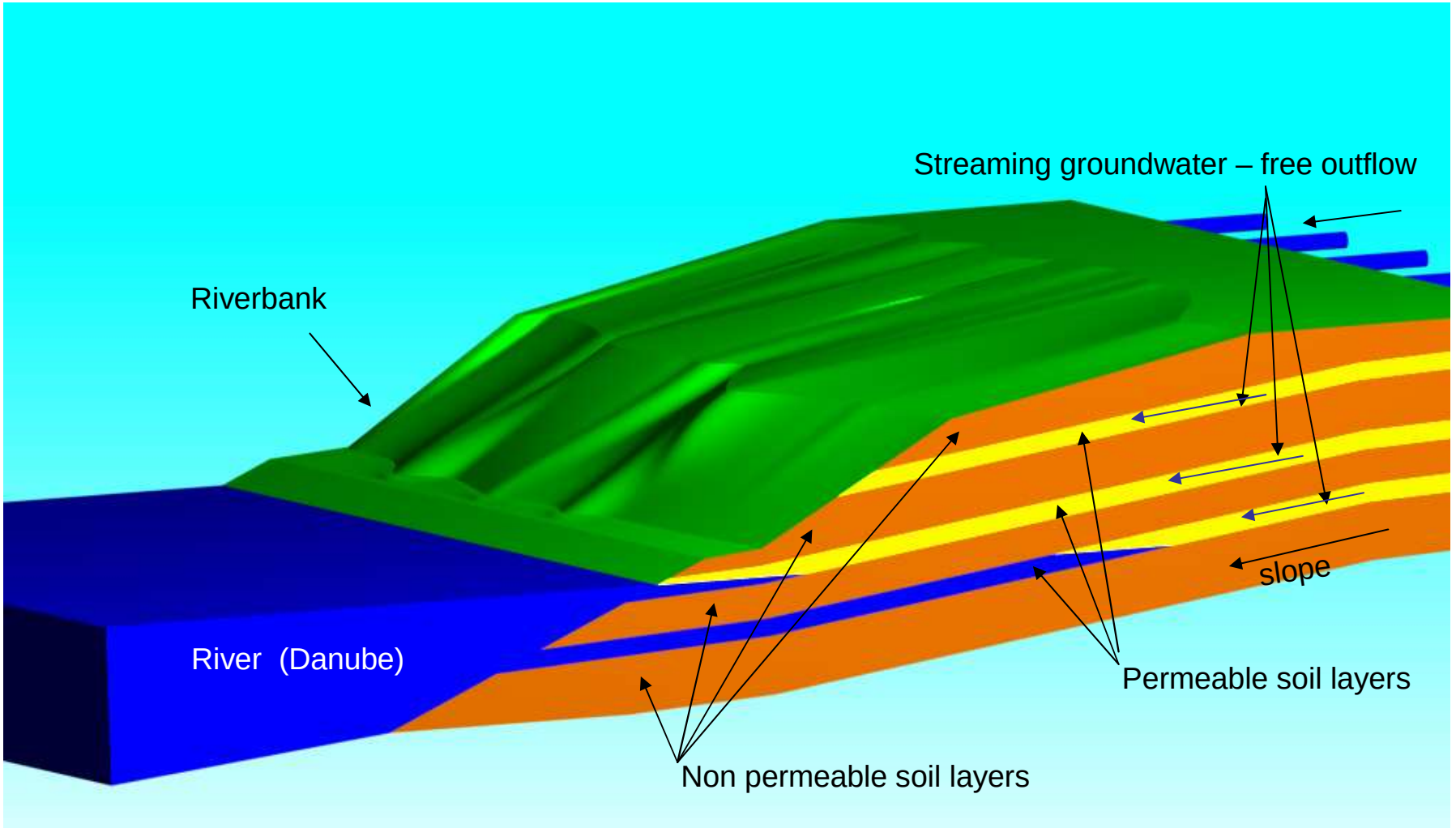


Fig. No. 2.
High tide, the permeable layers in water saturated condition

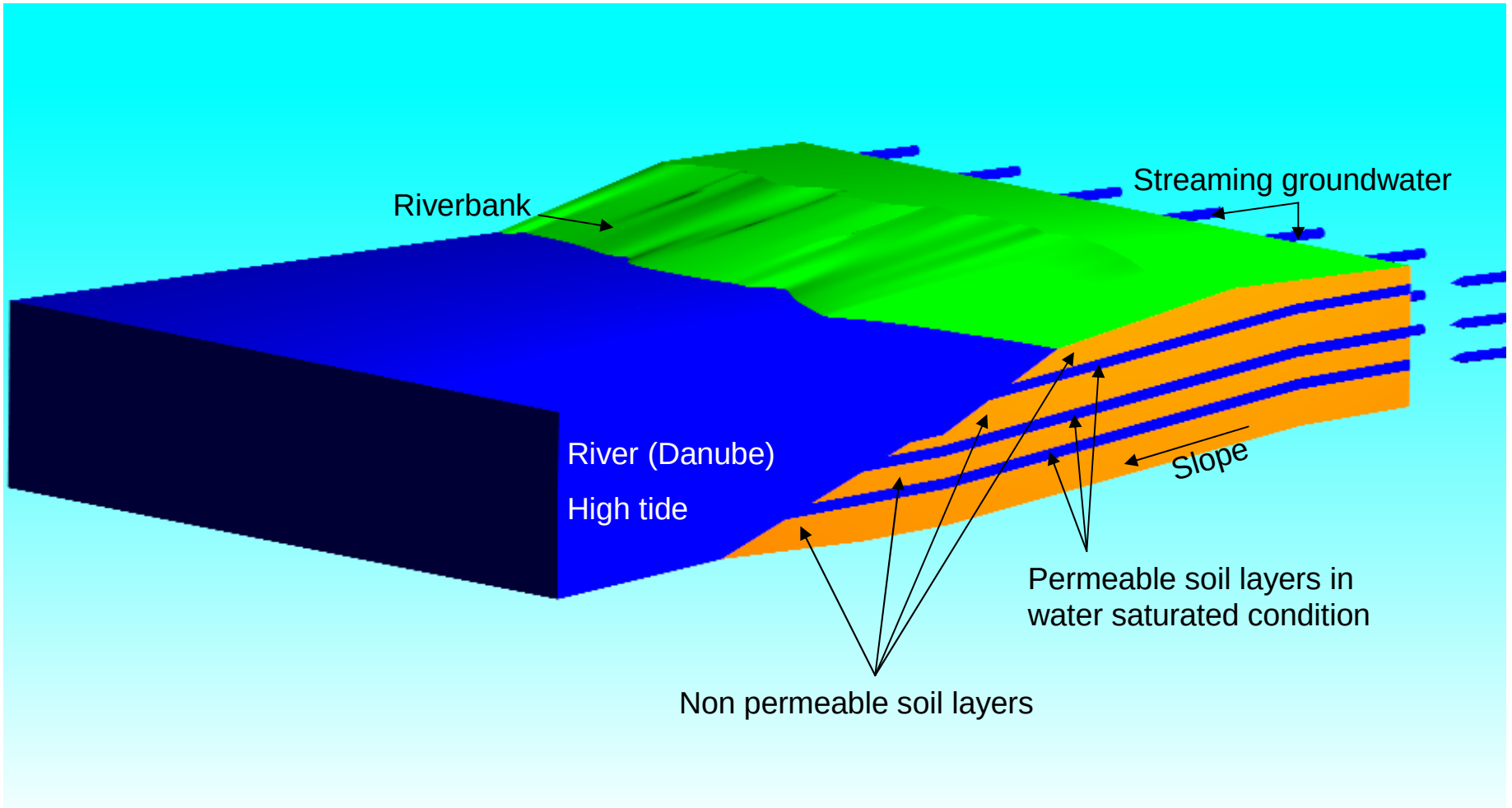


Fig. No. 3.
After high tide, the first step of sliding

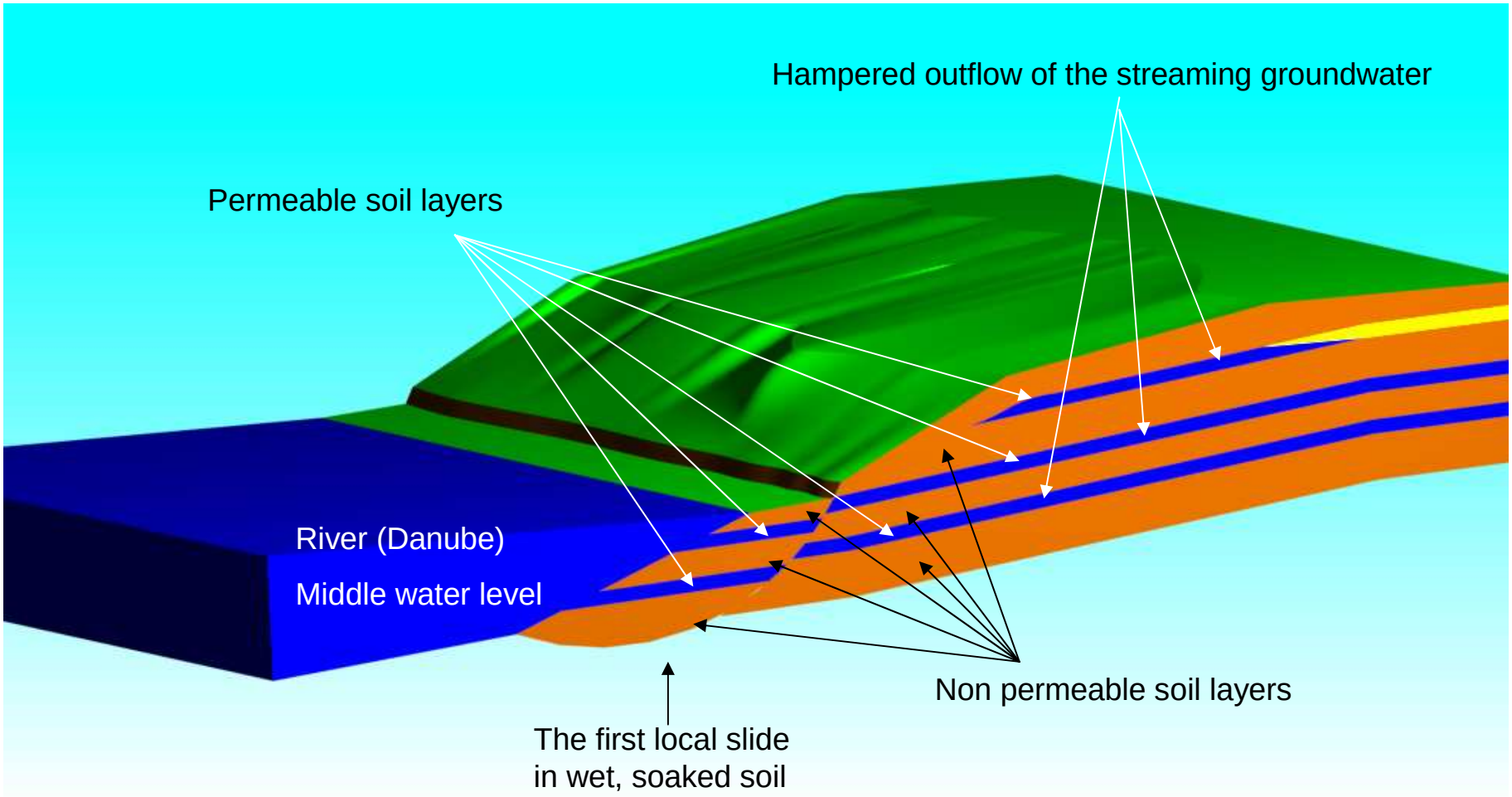


Fig.No. 4.
Next high tide, the permeable soil layers hampered the outflow, totally saturated again

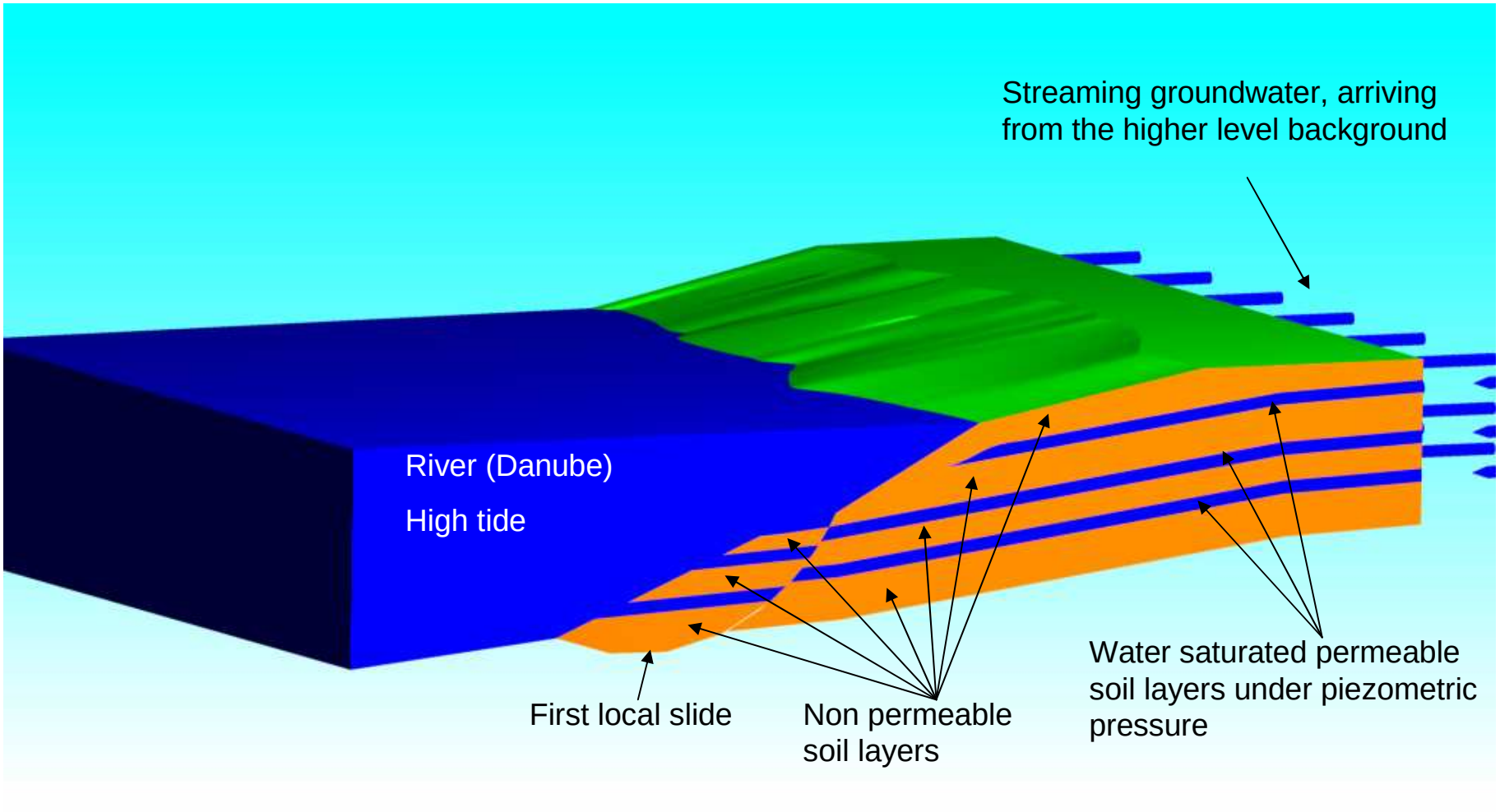
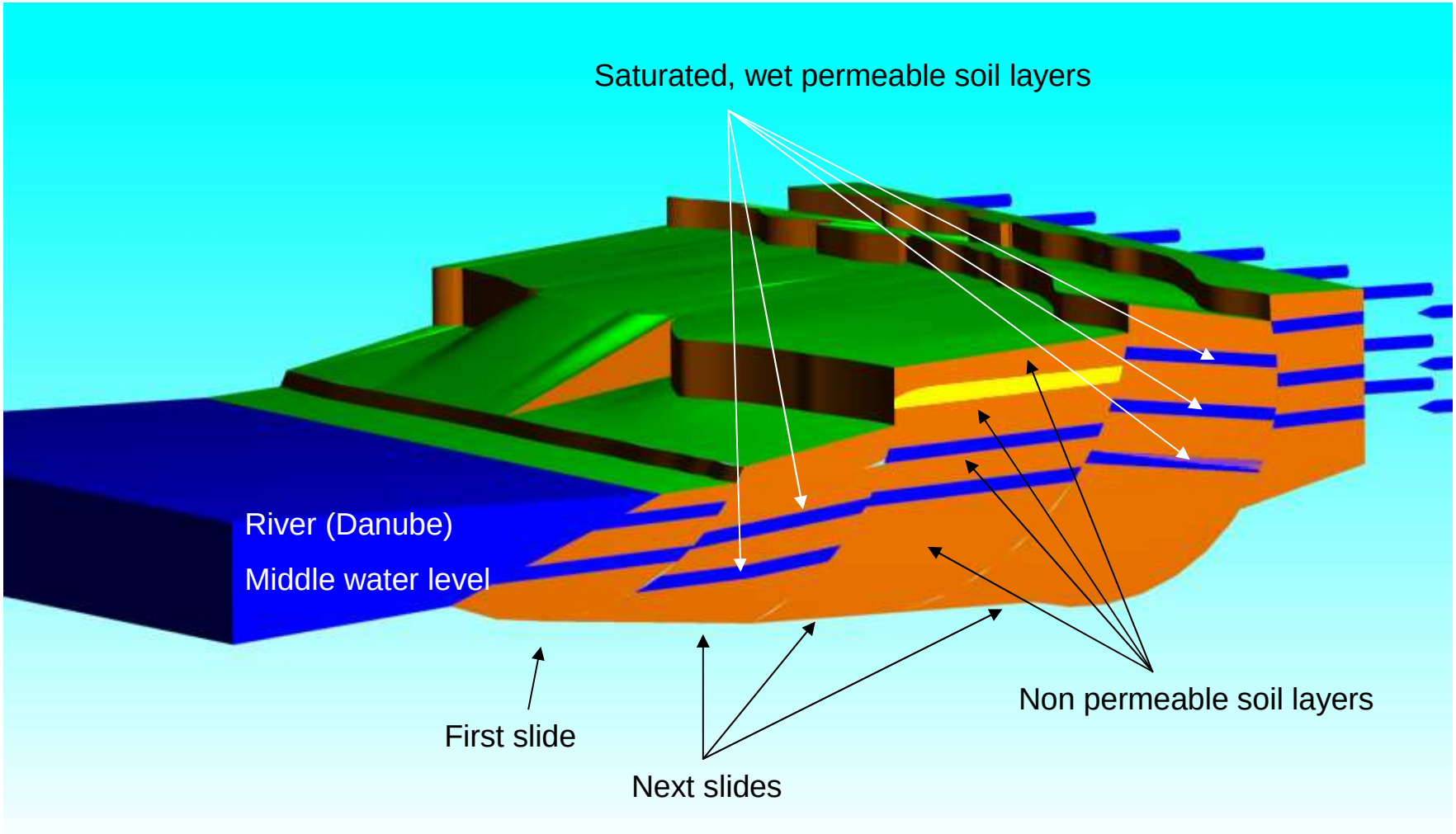


Fig. No. 5.

Situation after the next high tide, the water satureted permeable layers under remaining piezometric pressure – next slides occur….



How could the loss of balance be prevented between the volume of the streaming groundwater and the outflow capacity of the permeable soil layers?

There are two ways of recreating the balance:

- **Minimizing the water supply of the streaming groundwater**.
  (Reduction of the possible rainwater infiltration with grassing, plantation, lining the rainwater collector trenches, levelling and sloping of the uncovered soil surface, canalisation, rehabilitation of leaking public services etc.)
  In case of enormous long and/or heavy rainy periods this minimalisation can't be effective enough to prevent the landslides.

- **Extending the outflow capacity of the permeable soil layers.**

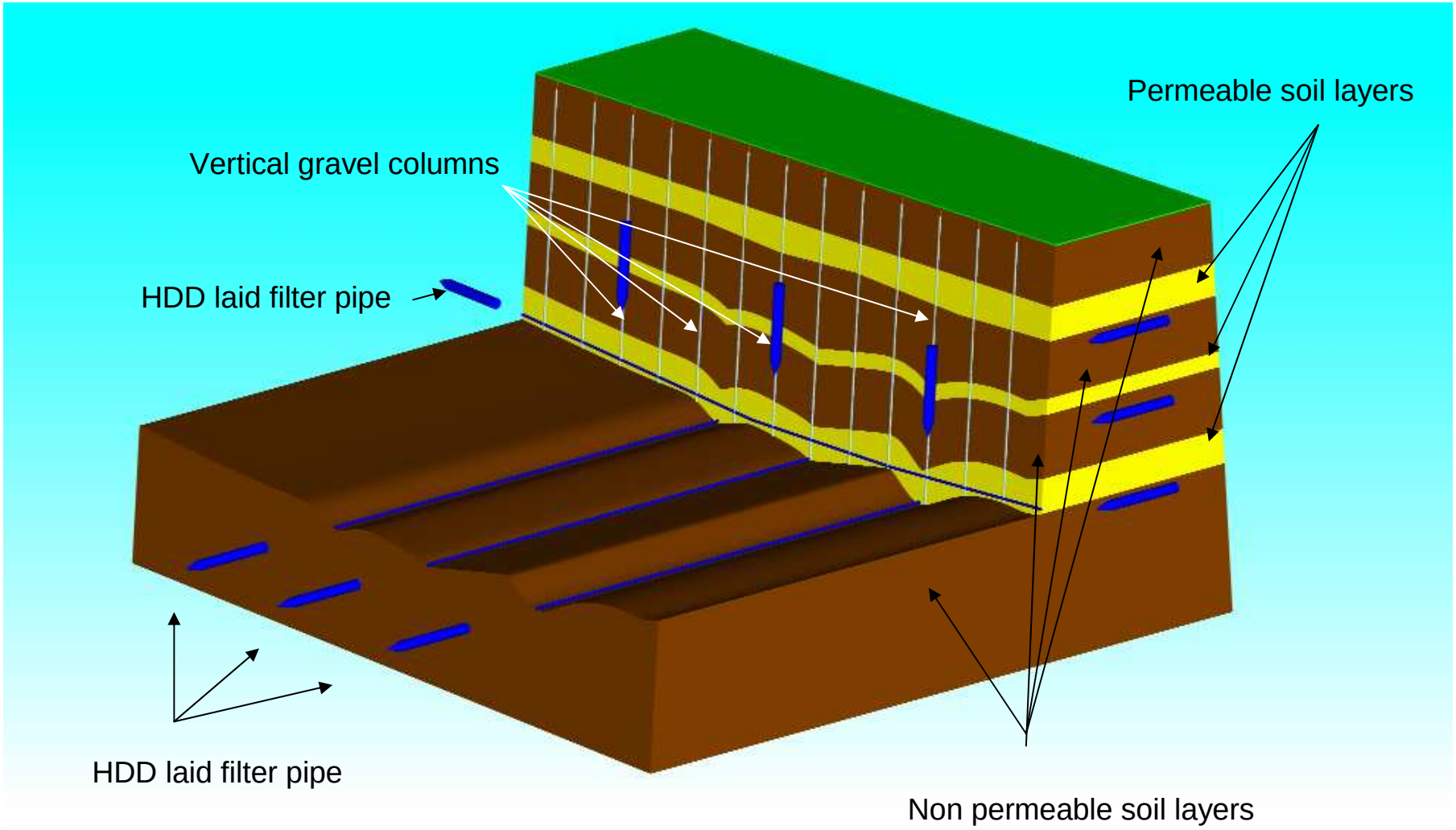
Applying both methods, this is the real solution !!!!!

Increasing the outflow capacity of the permeable soil layers (horizontally and vertically deep in the background)

Required steps:

- Well prepared geotechnical site survey (depth, thickness, slope, subsurface inclinations of the layers, etc).
- Sampling the soil layers for laboratory tests (granulometry, permeability, water content, cohesion, etc.).
- Installation of permanent water level control wells.
- Prior to the beginning of the construction work of bored subsurface drainage system it is necessary to measure the groundwater level.
- Detailed planning of the bored subsurface drainage system.
- Construction of vertical gravel columns - if required (to provide a connection between the permeable soil layers settled above each other).
- Laying the special plastic filter pipe for horizontal single drainage or drainage collector lines (HDD drilling or horizontal thrustboring with reusable steel casings).
- Measuring the fall of groundwater level in the control wells.

Fig. No. 6.
Deep drilled subsurface drainage system laid by HDD technology



An already completed prevention work at the earlier sliding riverbank of Danube in Ercsi/ Hungary

Thanks for your kind attention

Questions and comments?

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